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SUR LA QUESTION DE L'ACHONDROPLASIE ATY- PIQUE ET DE SA FORME PÉRIPHÉRIQUE

par

Nils Silfverskiöld

Professeur agrégé d'orthopédie à l'Institut Carolin de Stockholm

(Tabula XV—XVIII)

Observation I. H. J. Femme, âgée de 58 ans.

Pas de malformations connues dans l'ascendance ou chez les frères ou sœurs de la malade. Nie toute contagion syphilitique dans la famille. Du plus loin que se souvienne la malade ses mains et ses pieds ont été courts et larges.

À l'âge de trois ans les jambes auront commencé à se courber et au cours de l'âge d'accroissement elles se sont courbées de plus en plus jusqu'à ce qu'elles aient eu la difformité qu'elles présentent aujourd'hui (fig. 1). Ce n'est qu'à la suite d'efforts prolongés que la malade a souffert des pieds et des jambes. Elle a été myope depuis sa tendre enfance.

Etat le 29 janvier 1926 (fig. 1 a—c). Taille 154 cm. Poids 76 kgr. L'état général et l'intelligence n'offrent rien d'anormal. Cataracte sénile. Glande thyroïde au palper normale. Forme du crâne et du nez normale. Rien à noter également pour la voûte palatine et la denture. Les mains et les pieds sont courts et larges. Les doigts ne forment pas de « main en trident », et ont par rapport les uns aux autres une longueur proportionnelle. Les avant-bras montrent quelque raccourcissement. Structure du corps en outre proportionnée. Les jambes montrent immédiatement au-dessus de l'articulation tibio-tarsienne une déviation en varus d'où résulte le déplacement du pied. La partie postérieure du pied est en supination prononcée, la partie antérieure en pronation. La mobilité des articulations des pieds est modérément restreinte. Rien d'essentiel à noter pour la mobilité des autres articulations du corps. Faible augmentation de la cyphose dorsale.

Examen radiographique: Ce ne sont que les parties du squelette indiquées ci-dessous qui montrent des altérations perceptibles aux radiographies. Les noyaux osseux des articulations des genoux et des hanches sont peut-être un peu plus bas qu'ils ne le sont normalement.

Mains (Tabula XV, Fig. 2). Phalanges et os métacarpiens courts, gros, aux extrémités épaissies. Os carpiens essentiellement normaux. Le trapèze

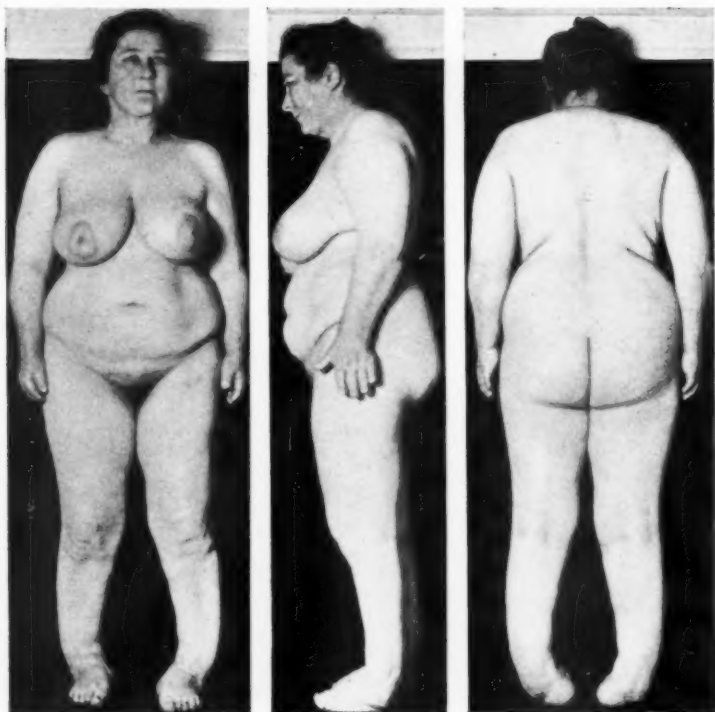


Fig. 1 a—c.

(multangulum majus) montre une ombre opaque dense. L'extrémité distale du radius est dirigée obliquement en confinant par l'apophyse styloïde au trapèze.

Pieds. Les phalanges et les métatarsiens sont courts et gros. Aussi bien l'astragale que le calcanéum (Tabula XV, fig. 3) est court et informe. L'astragale a la trochlée plate et le col et la tête peu marqués.

Jambes. Les épiphyses distales du tibia et du péroné présentent une déviation en varus, prononcée vers les diaphyses (Tabula XV, fig. 4) d'où résulte la position fortement oblique de l'articulation. La malléole interne, large et informe, a un noyau osseux particulier libre et se trouve plus approchée de 5 centimètres du bout proximal que la malléole latérale. Près de la ligne médiale du disque ossifié de l'épiphyse se trouve une exostose de la dimension d'environ un centimètre.

Articulations des genoux. Le tiers supérieur de la rotule paraît dans la direction dorsoventrale un peu aplati et possède un propre noyau osseux. Patella bipartita (Tabula XV, fig. 5).

Colonne vertébrale (fig. 6). La hauteur des disques intervertébraux de la région lombaire saute aux yeux. Une partie des vertèbres montrent des signes de spondylite déformante.

Observation II. K. J. garçon âgé de 14 ans. Fils de la précédente. Le malade n'a ni frères ni sœurs, seulement une demi-sœur (que j'ai examinée également), bienportante et sans malformations. Le malade est né à terme et était sain à la naissance. L'accouchement s'est écoulé normalement. Au dire *décidé* de la mère, les mains, les pieds et les jambes de l'enfant étaient à la naissance tout à fait normaux. Les altérations qu'on peut noter aujourd'hui se seront fait remarquer peu à peu et seront devenues plus frappantes avec l'avancement de l'âge. Le malade a commencé à marcher à l'âge d'un an et demi. A l'école, il a fait de bonnes études. Il a toujours été myope.

Etat le 21 janvier 1926 (fig. 7 a—c). Taille 148 cm. Poids 34 kgr. Le malade paraît chétif et de forces physiques un peu abaissées. Intelligence normale. Acuité visuelle O. D. G. 9 dioptries. Fonds des yeux normaux. Glande thyroïde au palper normale. Organes génitaux externes normaux. Le maintien est débile avec cyphose modérée. La forme du crâne indique le dolicocephale prononcé. Les mains et les pieds sont courts et larges et du même aspect que ceux de la mère. Immédiatement au-dessus de l'articulation tibio-tarsienne les jambes présentent une déviation en varus, d'où résulte le déplacement du pied. En outre, le squelette est cliniquement normal et proportionné. Pas de micro-mélie. La R. W. dans le sang négative.

Examen radiographique: Seulement les parties indiquées ci-dessous présentent un aspect divergent du normal.

Mains (Tabula XVI, fig. 8). Phalanges et os métacarpiens plus courts qu'à l'état normal, aux métaphyses larges, en partie en forme de coupe. Les disques épiphysaires ont des contours dentelés au cours irrégulier. Les noyaux osseux du carpe sont plus petits que les normaux, particulièrement ceux du semi-lunaire et les trois noyaux osseux radiaux. Le disque épiphysaire distal du cubitus (ulna) est de forme irrégulière. La métaphyse élargie l'entoure en partie en forme de coupe.

Pieds (Tabula XVI, fig. 9). Phalanges et os métatarsiens plus courts que les normaux. La plupart des disques épiphysaires sont ossifiés. La trochlée est un peu aplatie. L'astragale et le calcaneum sont courts et informes.

Jambes (Tabula XVI, fig. 10). Les épiphyses distales forment vers les diaphyses une déviation en varus assez importante d'où résulte la direction oblique de l'articulation. Les lignes épiphysaires distales ont un cours particulièrement



Fig. 6.

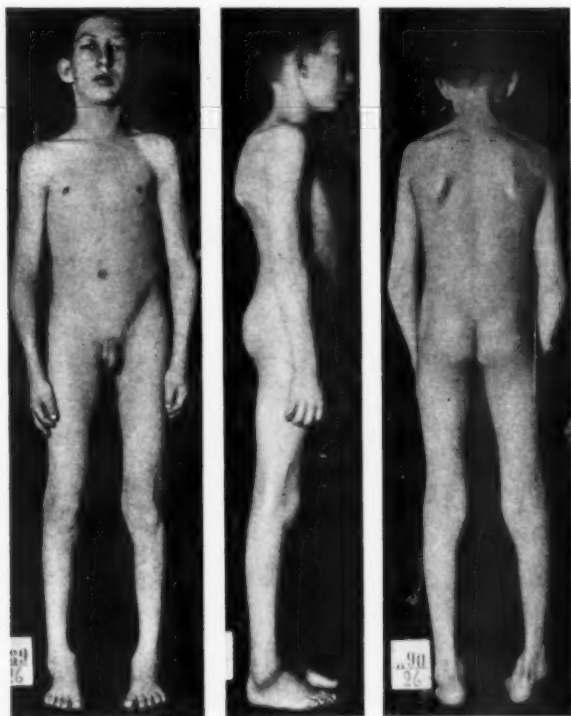


Fig. 7 a—c.

irrégulier. Le disque épiphysaire distal du tibia forme une ligne zigzagüée dont la partie latérale se trouve plus rapprochée d'environ un centimètre du bout distal que la partie médiale. Le noyau épiphysaire distal du tibia a médialement environ 2 cm, latéralement environ 1 cm de hauteur. La malléole médiale, qui a un propre noyau osseux libre, se trouve plus rapprochée d'environ 1.5 cm du bout proximal que la malléole latérale.

Colonne vertébrale. Plusieurs vertèbres dorsales montrent au dessin de profil (Tabula XVI, fig. 11) des parties antérieures en forme d'échelle, surtout marquées à la 7^e et à la 9^e dorsale, les corps de ces dernières présentent aussi une hauteur diminuée. Les disques intervertébraux de la colonne lombaire sont peut-être plus haute que dans l'état normal.

La forte ressemblance du syndrome chez la mère et le fils se jette ici aux yeux. (Obs. I et II). Abstraction faite des altérations de la colonne vertébrale relativement peu frappantes, on trouve les tableaux pathologiques exclusivement dans les parties distales des membres. Les avant-bras de la mère présentent quelque raccourcissement. Le rac-

courcissement des jambes est apparent et dépend de la déformation. Ni l'examen clinique ni les radiographies n'indiquent le rachitisme ou la syphilis, ni des troubles connus d'origine endocrine. Pour certains détails des parties distales des jambes les cas montrent des altérations singulières. J'ai vu des altérations similaires, quoique non identiques, dans d'autres articulations dans quelques cas d'achondroplasie; j'ai de même trouvé dans la littérature des observations pareilles. Les deux cas présentent une extra-épiphyse de la malléole médiale. Le squelette de la main et du pied présente souvent chez les achondroplasiques des extra-épiphyses. Les déviations en varus des jambes sont très prononcées. On en trouve la correspondance chez d'autres cas d'achondroplasie, surtout pour ce qui regarde les articulations des genoux (*genua valga* et *vara accentués*) mais aussi dans d'autres articulations. Si nous nous en tenons aux altérations des squelettes des mains et des pieds, il est hors de doute, cela me semble, qu'elles présentent le tableau de l'achondroplasie. L'an dernier, j'ai réuni dans un mémoire (4) dans cette revue plus de vingt symptômes indiqués dans la littérature comme traits caractéristiques de l'achondroplasie, et, à cause de l'espace limitée, je me borne ici à y renvoyer. Ils s'accordent avec les symptômes des observations I et II de ce mémoire seulement pour ce qui regarde les mains et les pieds.

En comparaison, je rendrai quelques tableaux provenant d'un autre cas d'achondroplasie de notre clinique, étant d'intérêt également par ses traits exceptionnellement marqués. Une description détaillée de la malade nous mènerait ici trop loin.

Observation III. H. S. femme âgée de 28 ans. Taille 79 cm. Voir en outre fig. 12 (a, b). Radiographie de main voir fig. 13 et d'articulation scapulo-humérale fig. 14. (Observez l'aplatissement de la glène et la grosse tête volumineuse.)

Or, la question se pose ainsi: Est-ce qu'on pourra pour les observations I et II poser le diagnostic d'achondroplasie? Nous trouvons chez FRANGENHEIM (1) dans son travail modèle de l'an 1913 une description détaillée de l'achondroplasie. Il dit entre autre: «Das Radiogram der Hand genügt zur Stellung der Diagnose Chondrodystrophie.» Mais il continue que voici: «Ein unproportionierter Zwergwuchs ist der Endausgang der gestörten Knochenbildung» et «Die Chondrodystrophiker erreichen, wenn sie erwachsen sind, eine Grösse von 1.10 bis 1.30 m».

Dans les cas où l'achondroplasie a été observée chez des malades dont les disques épiphysaires ne sont pas encore ossifiés, l'examen histologique peut essentiellement contribuer à la détermi-

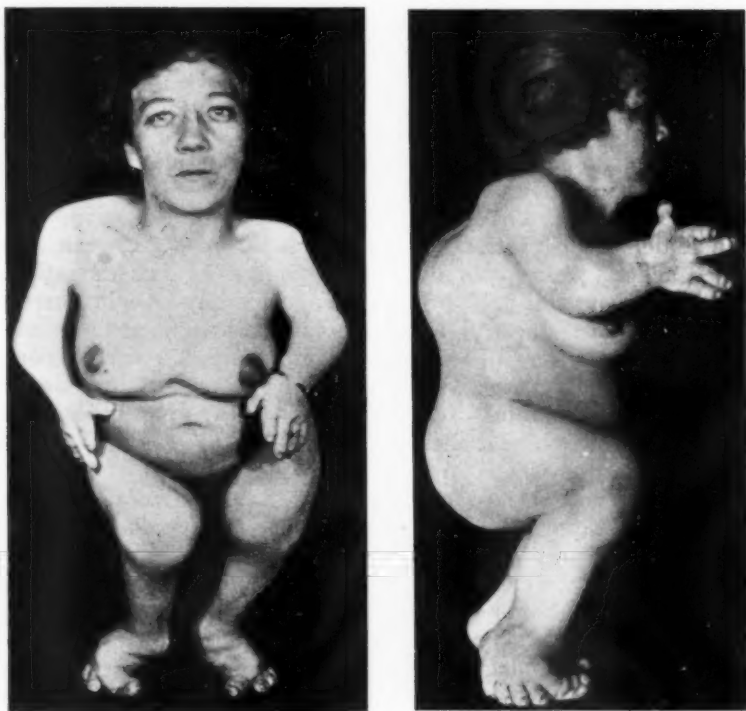


Fig. 12 a, b.

nation sûre du diagnostic. Il est douteux pourtant qu'on soit autorisé de faire l'excision d'une partie du disque épiphysaire. Restent donc les symptômes établis par l'examen radiographique. On se pose donc la question suivante: quels symptômes et combien de ceux qu'indique la littérature faut-il exiger pour que le diagnostic d'achondroplasie soit justifié? En renvoyant au mémoire cité plus haut où j'ai réuni les symptômes indiqués dans la littérature comme caractéristiques de l'achondroplasie, je veux dire que selon mon avis, vue de notre connaissance, jusqu'ici défectueuse, des maladies du système osseux du squelette croissant, on ne pourra guère donner une réponse exacte à cette question pour ce qui regarde un assez grand nombre de cas.

Nous avons dans notre clinique au cours des cinq dernières années posé le diagnostic de l'achondroplasie dans 12 cas (y compris obs. I et II de ce mémoire). A l'examen de ces cas et d'un assez



Fig. 13.



Fig. 14.

grand nombre de ceux qui sont décrits dans la littérature j'ai trouvé: 1° que l'existence et l'absence des symptômes dits caractéristiques varient beaucoup, 2° que de petites altérations particulières (des anomalies) de détails ne sont pas rares (voir par exemple obs. II et IV).

Ajoutons à cela les observations où vraisemblablement la maladie n'est pas congénitale mais acquise [voir par exemple KRABBE (2)], et les observations où les altérations n'existaient peut-être pas à la naissance, mais — sans intervention de maladie connue — n'ont paru que peu à peu (*forma tarda*). Il n'est pas exclu que l'observation II indiquée plus haut appartienne à cette catégorie; la mère dit avoir, à cause de la brièveté de ses propres mains et pieds, soumis l'enfant à un examen rigoureux à ce point de vue.

Il y a en outre des cas qui ont été décrits comme représentant une combinaison de l'achondroplasie et d'autres maladies. NONNE (3) en donne l'exemple en faisant la description de trois enfants de la même famille chez qui il a trouvé la combinaison de l'achondroplasie avec le myxœdème.

Mon cas déjà nommé (4) peut être considéré comme une forme fruste de l'achondroplasie avec plusieurs symptômes de « malacies locales ». Je ferai plus loin une brève description d'encore un cas d'achondroplasie avec des altérations similaires (voir observation IV).

On ne pourra nier que des troubles d'origine endocrine ne puissent faire partie de la pathogénie de l'achondroplasie, aussi dans les cas dits véritables où il n'y a pas de symptômes de troubles connus d'origine endocrine. Nos connaissances jusqu'ici du système endocrinien sont sans doute très défectueuses, et l'on a le droit de supposer, cela me semble, que non seulement les glandes endocrines, mais aussi la plupart des autres organes du corps humain ont des fonctions endocrines réciproques. Tant que dureront les difficultés de trouver des points d'attaque de ces problèmes, il serait d'importance, il me semble, de s'occuper dans une plus large mesure qu'on ne l'a fait jusqu'ici peut-être, de l'examen radiographique du squelette entier, de même qu'on devait suivre le développement des cas au cours de tout l'âge de croissance.

Je veux dans cet ensemble entrer quelque peu dans la question actuelle de *l'achondroplasie dite partielle ou locale*.

Dans mon mémoire cité plus haut j'ai relaté un cas publié de SIEGERT avec des symptômes achondroplasiques, localisés à seulement l'une des moitiés du corps et des cas publiés de BUDDE, où il regarde la maladie comme acquise et comme « *forma tarda* » de l'achondroplasie localisée.

Je citerai ici quelque peu en détail certaines parties de deux

mémoires intéressants de la *Revue neurologique*, donnant un bon exposé de la situation actuelle de la question de l'achondroplasie dite partielle ou localisée.

KNUD H. KRABBE (2) (Copenhague), l'auteur de l'un des articles, écrit en résumant entre autre:

« Nous trouvons souvent dans la littérature des descriptions de cas qui sont dénommés: achondroplasie partielle ou atypique. Ces cas ressemblent à l'achondroplasie vraie en ce qui concerne le raccourcissement des extrémités, mais ils en diffèrent en ce que l'enfoncement de la racine du nez manque toujours, et quelquefois aussi la main en trident. Quelques-uns de ces cas sont d'origine post-natale, apparus après des maladies aiguës... Il existe des descriptions de cas de micromélies hérédofamiliales où la micromélie est limitée aux mains de sorte qu'il se présente une main en trident. Nous y ajoutons la description d'un cas. Il est possible, mais pas du tout certain, que ce soient des cas d'achondroplasie partielle. »

Les paroles suivantes de KRABBE concernant la pathogénie de ce qu'il appelle « l'achondroplasie fœtale vraie » sont dignes de remarque:

« Il a été démontré par plusieurs auteurs que l'achondroplasie est une maladie familiale. En 1912, SOUQUES a présenté une famille d'achondroplasiques à la Société de Neurologie en ajoutant qu'il avait trouvé dans la littérature 17 autres cas d'achondroplasie familiale parmi les 86 cas d'achondroplasie dont il était alors question. Il ne s'agit donc pas d'une accumulation, mais d'une maladie hérédofamiliale, comme les myopathies, comme la maladie de FRIEDREICH, comme la chorée de HUNTINGTON; se sont des maladies qui, avec la plus grande probabilité, sont héritées selon les lois de MENDEL et qui sont probablement dues à ce que GOWERS a dénommé une abiotrophie de certains éléments. Dans l'achondroplasie, il s'agit vraisemblablement d'une abiotrophie fœtale des éléments de croissance des lignes épiphysaires. »

Le second mémoire (5), intéressant surtout au point de vue phylogénétique, provient de S. A. TCHOUGOUNOFF et A. D. SOURKOFF (Moscou). De leurs recherches mérite d'être cité ce qui suit:

« L'élaboration du chapitre concernant l'achondroplasie est arrivée à la période où l'étude de ses traits typiques relativement à la clinique et l'anatomie pathologique est achevée et où vient le tour du problème de la connaissance détaillée avec les formes non typiques, incomplètes et limitrophes d'autres maladies de la même famille... Ce parallèle entre la myopathie et l'achondroplasie peut être étendu davantage. En suivant la classification de ROTH, nous connaissons parmi les atrophies idiopathiques des muscles: 1° la forme centrale ou rhizomélique; 2° la forme périphérique; 3° la forme transitive

entre les deux premières. Les cas typiques de l'achondroplasie peuvent être divisés en groupes semblables: la forme qu'on rencontre le plus souvent est celle du type rhizomélique de P. MARIE. A côté de cela on peut noter des cas de type périphérique de l'achondroplasie. On peut rapporter à ce type périphérique les cas de CHAVIGNY et de J. A. PIRES, où il y avait eu le raccourcissement des os de la main de caractère achondroplasique. Dans le 4^e cas de K. KRABBE, chez un ouvrier de 16 ans, il s'agissait d'un raccourcissement considérable des pieds à côté d'un développement comparativement bon d'autres segments des extrémités. Il est vrai que cet auteur considère son cas, ainsi que les autres cas de l'achondroplasie partielle comme «pseudo-achondroplasie» et il les fait dépendre du rachitisme. Mais nous considérons ce point de vue comme erroné. K. KRABBE n'attribue à la véritable achondroplasie que les cas qui présentent le type rhizomélique et qui sont suivis de l'enfoncement du nez à sa racine et de la main en trident. Nous nous permettons d'y objecter: si l'on ne se basait que sur ces symptômes pour faire la diagnose de l'achondroplasie, on rétrécirait par trop les limites de cette maladie. Chaque affection dégénérative et héréditaire se caractérise par la variété de sa localisation et par l'abondance des formes transitives. Si nous considérons l'achondroplasie comme maladie hérédo-dégénérative, nous ne devons pas exclure les cas aberrants. D'un autre côté il n'y a pas de raisons concrètes d'attribuer les cas partiels de l'achondroplasie au rachitisme. Le rachitisme, même dans sa forme grave, n'aboutit pas au nanisme du type achondroplasique. De cette manière nous sommes disposés à compter ce 4^e cas de KRABBE parmi ceux de l'achondroplasie mais d'une localisation périphérique.»

Les malades de mes observations I et II décrits plus haut, montrent des troubles héréditaires dans l'accroissement des os d'origine enchondrale et de localisation périphérique. En renvoyant à la citation ci-dessus, je me trouve autorisé de les rapporter à l'achondroplasie du type partiel de localisation périphérique.

Pour finir je veux donner une brève description d'un cas de notre clinique présentant au dehors des symptômes de l'achondroplasie la rotule tripartite et le type d'articulation de hanche rappelant celui de la maladie de CALVÉ-LEGG-PERTHES-WALDENSTRÖM.

Observation IV. K. B. garçon âgé de 9 ans. On nie l'hérédité et la syphilis. La mère ne montre aucuns signes cliniques de syphilis, ni des signes radiologiques ou cliniques d'achondroplasie, si ce n'est un tout petit raccourcissement des extrémités supérieures. La mère II-pare. Au premier accouchement on a fait l'embryotomie, le second a été terminé par une application de forceps. La brièveté des mains du malade fut notée dès la naissance. Né à terme, le garçon paraissait sain à la naissance.

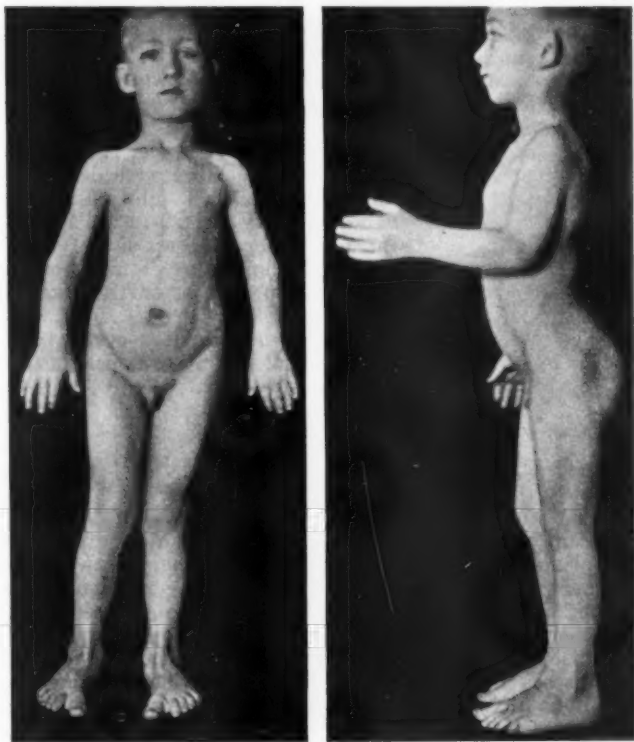


Fig. 15 a—b.

Etat le 26 mars 1926 (fig. 15 a, b). Pas de signes de syphilis ou de trouble connu d'origine endocrine. Poids 24 kgr. Taille 122 cm. Intelligence normale. *Etat* général bon. Force musculaire normale. Le crâne, le nez, le palais et la denture sont normaux. Micromélie rhizomélisque, surtout manifeste aux extrémités supérieures. Les mains sont larges, modérément raccourcies. Les pieds sont plus courts que dans l'état normal avec metatarsus varus. Genua valga. Coxa vara (contracture flexionnaire environ 20°). La plupart des extrémités articulaires modérément épaissies. Légère lordose, due à la contracture flexionnaire. Les épiphyses des côtes ne sont pas épaissies. La ceinture scapulaire n'offre rien d'anormal.

Examen radiographique (à cause de l'espace limité je ne décris ici que les parties du squelette ayant de l'intérêt par rapport à mon sujet):

Mains (Tabula XVII, fig. 16). Les os métacarpiens et les phalanges montrent à un degré modéré du raccourcissement, de l'infmté et des épiphyses épaissies. Leurs noyaux épiphysaires sont, ainsi que les noyaux épiphysaires distaux de l'avant-bras, développés d'une façon inégale, ils sont plats ou font encore défaut. Les noyaux des os carpiens sont normaux.

Articulations des genoux (Tabula XVII, fig. 17 et 18 b; fig. 17 a à l'âge de 7 ans). Les épiphyses du fémur et du tibia formant les articulations des genoux sont larges et bas.

La rotule a trois noyaux osseux, séparés les uns des autres.

Le bout proximal de la tête du péroné est plus éloigné de l'articulation du genou qu'en état normal.

Articulations scapulo-humérales (Tabula XVIII, fig. 19). Le noyau osseux plat de l'épiphyse de l'humérus présente une ombre avec des alternatives de densité et de transparence. Le noyau osseux de la glène est également plat.

Articulations des hanches [Tabula XVIII, fig. 20 (a à l'âge de 7 ans, b à l'âge de 9 ans)]. Le col, d'une structure normale, est large et informe. Le noyau de la tête m'est représenté que d'une mince lamelle osseuse opaque, entourant en forme d'arc la ligne supérieure de la partie proximale du col. La glène est essentiellement normale.

Pieds (Tabula XVIII, fig. 21). Os métatarsiens courts, gros, formant avec le tarse un angle médialement ouvert. Les noyaux osseux des épiphyses des quatre os métatarsiens latéraux présentent du côté distal quelque aplatissement; les lignes épiphysaires sont ossifiées.

RÉSUMÉ

En illustrant de quatre cas son exposé, l'auteur traite la question de l'achondroplasie atypique et sa forme périphériquement localisée. Deux malades, mère et fils, montrent des altérations en général identiques, localisées surtout aux parties périphériques des extrémités, causées de troubles de l'ossification enchondrale et de caractère achondroplasique. Un autre des cas achondroplasiques présente la rotule tripartite ainsi que des radiographies des articulations scapulo-humérales et des articulations de hanches rappelant ceux qu'on obtient aux « malacies locales » (par exemple la maladie de CALVÉ-LEGG-PERTHES-WALDENSTRÖM).

SUMMARY

The question of atypical achondroplasia and its peripheral localisations is being dealt with in the light of four cases. Two cases, mother and son, show on the whole identical skeletal changes, mainly localised to the peripheral parts of the extremities and caused by disturbances in the enchondral ossification and of achondroplastic nature. Another case of achondroplasia shows a tripartite patella and the X-ray pictures of shoulder- and hips joints remind of the so called local malaciae (CALVÉ-LEGG-PERTHES-WALDENSTRÖM, and others).

ZUSAMMENFASSUNG

Verfasser behandelt an der Hand von vier Fällen die Frage der atypischen Achondroplasie und ihrer peripher lokalisierten Form. Zwei Fälle, Mutter und Sohn, zeigen im grossen und ganzen identische, vor allem in den peripheren Extremitätsteilen lokalisierte Skelettveränderungen achondro-



Fig. 2.



Fig. 3.



Fig. 4.



Fig. 5.



Fig. 8.



Fig. 10.



Fig. 9.



Fig. 11.



Fig. 16.



Fig. 17.



Fig. 18 a-b.



Fig. 19.



Fig. 21.



Fig. 20 a—b.

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1)

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3)

4)

5)

plastischen Charakters infolge von Störungen der enchondralen Knochenbildung. Ein anderer von den achondroplastischen Fällen zeigt Patella tripartita und gibt Röntgenbilder der Schulter und Hüftgelenke, welche an die der sogen. lokalen Malazien erinnern (CALVÉ-LEGG-PERTHES-WALDENSTRÖM u. a.).

LITTÉRATURE

- 1) FRANGENHEIM, P.: Die Krankheiten des Knochensystems im Kindesalter. Neue deutsche Chir. Vol. 10, Verlag Enke.
- 2) KRABBE, H.: L'achondroplasie et les cas pseudo-achondroplasiques. *Revue neurol.* vol. 39, I, 1923.
- 3) NONNE, M.: Familiäres Vorkommen (3 Geschwister) einer Kombination von imperfekter Chondrodystrophie mit imperfektem Myxoedema infantile. *D. Zeitsch. f. Nervenhe.* 1924—25, p. 263.
- 4) SILFVERSKIÖLD, N.: A »forme fruste» of chondrodystrophia with changes simulating several of the known »local malacias». *Acta radiol.*, Vol. IV, Fasc. 1, 1925.
- 5) TCHOUGOUNOFF, S. A. et SOURKOFF, A. D.: Sur la question de la pathogénie et des formes cliniques de l'achondroplasie. *Revue neur.* 1924, II, p. 253.



OBSERVATIONS ON THE FUNCTION OF THE STOMACH AFTER GASTROENTEROSTOMY AND SIMILAR OPERATIONS

by

Dr. L. Arisz, the Hague

(Tabula XIX)

From the quite different descriptions given by several roentgenologists of enterostomised stomachs one may conclude, that it is impossible to give a definite scheme, correct for all cases. As the operation is performed to obtain a more rapid discharge of the gastric contents special attention was paid in the roentgenological examinations to the way in which these contents passed into the intestine and the time wanted for clearance. Among the numerous descriptions given I'll mention, that CARMAN in nearly all cases observed, that the opaque mass passes freely through the stoma and that this persists even after the lapse of years; the anastomosis may be passed in a continuous, an intermittent or a rhythmic way, but part of the contents spontaneously may pass through the pylorus; as a rule, however, the passage through the anastomosis is the most important. The stomach empties in considerably less time than the normal stomach, there is no retention after six hours. CASE described cases in which the stomach empties rapidly until the level of the anastomosis is reached; then the emptying goes on slowly, a residue remaining for eight or more hours; he however thinks those cases to be normal in whom the stomach is empty after $4\frac{1}{2}$ —6 hours. GOETZE in most cases observed that the stomach fills normally, that the contents flow into the intestine within two hours in an intermittent way through the anastomosis; only in some cases, when the stoma happens to be in level with the lowest part of the greater curvature, the contents pass in a very short time.

In my observations on enterostomised stomachs nearly always different conditions were seen; so I must agree, that it is impossible to give a general scheme, that proves to be right in every case; it is impossible to give a definite rule about the normal post-operative function, consequently I'll give an analysis of the conditions found in

several individual cases and discuss their relation to the physiological function and their influence upon gastric pathology.

Site of the anastomosis: In several patients examined in the vertical position the anastomosis can be seen; it usually occupies a position at the backwall, thus it cannot be made visible in dorsoventral radioscropy, but only when examined in oblique directions; yet it may be difficult even in these directions to see the anastomosis, when it is covered by the communicating jejunal loop. In patients lying prone more often a good lateral picture may be obtained, whereas in one case an en-face-projection was found (Tab. XIX). Recent examinations of HELLMER show, that the folds of the mucous membrane are directed towards the anastomosis and that the opening has not a smooth, but an irregular contour; in a case however observed by me, a little barium-mixture retaining between the folds of the mucous membrane showed broad stripes, parallel on each other; the area where the anastomosis was expected to lie showed a homogeneous circular shadow with about 1 1/2 cm. diameter, covering about three stripes; probably this must be interpreted to be a small quantity of the bariummixture filling the anastomosis, so the stoma in this case is a round one with sharp and rather regular contours, without folds, the folds of the mucous membrane thus keeping the normal direction. If this view is the correct one the folds converging to the opening as found by HELLMER must be accidental and it is not proved, that they always adapt to the changed way of the discharge.

GOETZE stated, that generally the opening is not found at the greater curvature, where the surgeon intended it to lie. He examined the site of the opening relative to the greater curvature by suturing small metal balls in the anastomosis, that after a few days separated spontaneously; in this way he determined, that nearly always the opening was a few centimeters above the lowest part. His observation seems to be correct; I found the anastomosis at a rather great distance of the lowest part specially in deep ptotic stomachs; then the stomach may fill to a considerable extent before the level of the opening is reached. In non-ptotic stomachs also a distance between the anastomosis and the lower pole may be observed, but only if the stomach has been already partly filled; when I observed the first opaque mass taken, I saw it sinking just to the spot of the anastomosis and passing without delay into the intestine; when next a larger quantity was taken, it partly passed through the anastomosis and partly flowed along, thus indicating the form of the lower pole of the stomach at about the same level as the anastomosis and not below it. So the opening was at the very spot, where it was intended to lie. When still more bariummixture was taken, the lower pole of the stomach sunk deeper, but the anasto-

mosis did not sink in the same degree, so the distance between both increased in the way observed by GOETZE. I might explain this observation thus, that the anastomosis usually is situated in the very part, where it is meant to lie, but that it cannot move as well as the normal stomach does; so a torsion of the stomach around its axis will occur and the lowest part of the stomach is not any longer formed by the greater curvature, but by a part of the frontwall. When the anastomosis then is not found at the lowest pole of the stomach, it is not the surgeon's fault, but the result of adhesions in the anastomosis-area. Hence it is obvious, that in various patients different positions of the anastomosis must be found.

Mobility of the stomach: The normal mobility of the stomach has been interfered with after gastroenterostomy because the posterior wall at the site of the anastomosis has been fixed to the mesocolon. In the vertical position this fixation is not easily detected, but in the right lateral position the stomach does not move as far to the right, as is usually seen; the duodenal bulb and the pyloric part in this position remain visible and are not covered by the projection of the corpus ventriculi. The mobility is not always diminished in the same degree; sometimes the lesser curvature remains a straight line, sometimes it is divided into two parts, one forming a sac in front of the spinal column and one forming a sac down to the right side (Fig. 3). In the cases, where after the operation adhesive processes did develop, the movement of the stomach may be still more diminished; sometimes movement may be nearly impossible, as is shown in fig. 6.

Filling: When we examine a patient, upon whom a gastroenterostomy has been performed, when drinking in the vertical position, we see the first small mass of the bariummixture passing between the folds of the cardiac part, and sinking down to the greater curvature, where it immediately passes through the opening and moves quickly into the jejunum; the next small quantity drunk will follow the same direction, but a small part of it, especially when the quantity taken is not small, will flow over the opening and remain in the stomach, where it reaches the lower pole, thus indicating the site of the greater curvature. The relation between the quantity flowing through the stoma and that passing over it is different in various patients; sometimes nearly the whole intake leaves the stomach and only when the patient is drinking very fast, it cannot pass as rapidly into the jejunum and the stomach is filled itself. In other patients the passage through the stoma is slow and also when the bariummixture is drunk rather slowly, the stomach is filling just as in the normal increasing in all dimensions, the lower pole gradually sinking.

When we examine a patient swallowing in the right lateral posi-

tion, the filling is different. The opaque mass flows along the lesser curvature to the lowest part and does not touch the anastomosis, so the pyloric part of the stomach is filling first; when the level of the anastomosis is reached, passage into the jejunum will occur; sometimes a continuous discharge is seen, sometimes only a small quantity is flowing through the opening. As a rule the stomach and especially its pyloric part is more easily filled when the patient is lying on his right side, than when he is standing.

Form of the stomach: When the mobility of the stomach is not diminished by adhesions, the stomach, when filled with 400 ccm of the opaque mass, has the same form in the vertical position as before operation, unless it was formerly enlarged by a residue due to obstruction of the pylorus. It cannot be stated that after the operation the size has been diminished, as it accommodates to the contents; only when the contents cannot attain the ordinary volume, the stomach emptying too soon, the stomach is seen to be small, but this is not the result of shrinking; the form then is not otherwise as it would be, when a normal stomach is filled with a small quantity of opaque mass. The form of the stomach may be deformed, when adhesions fix the greater curvature at several places to the adjacent parts, then e. g. it can be divided into several bow-shaped parts or the walls of the pyloric part may seem to be pressed together in such a way, that the contents cannot well pass through. I, however, observed a good filling of the stomach, also of its pyloric part in a patient, who became operated again, in whose case so many adhesions were found, that it was impossible to liberate the stomach completely. That adhesions do not inevitably cause a defective filling of the pyloric part and in every case, where an unusual form will be found, one must carefully consider if other causes e. g. spasm may be able to explain it, before one is justified to diagnose adhesions.

Peristalsis: As an ulcer of the lesser curvature always disturbs the regular movement of the peristaltic waves, the possibility of peristalsis after gastroenterostomy should not be judged on the type of waves seen in stomachs with an ulcer of the lesser curvature; only stomachs, that were enterostomised without an ulcer found or with a duodenal ulcer should be studied. In a part of the stomach, that is poorly filled, waves are not well to be seen; as the filling of the pyloric part often is better in the lateral or prone positions than in the vertical one, they should be used by preference. In such conditions always peristaltic waves may be seen, mostly beginning in the area of the gastric angle, travelling along both curvatures, moving the wall without an irregularity just as in the normal stomach and forming a beautifully round antrum. The anastomosis seems to be no impediment

for the waves; most often waves are only seen in the part distal of the anastomosis, sometimes however they start above it and then the area of the anastomosis moves also well. Adhesions between the stomach and its surrounding tissues do not necessarily give hindrance for the peristaltic waves. I could state this fact in the patient mentioned above; the pyloric part of her stomach moved quite beautifully at both lesser and greater curvatures and yet a second operation showed such extensive adhesions, that the planned resection could not be performed in the usual way (fig. 2).

Clearance: The description of the filling of the stomach already included some remarks on the mechanism of the discharge. When in a standing patient the stomach is well filled, either because the



Fig. 2. Peristaltic movement of an enterostomized stomach, the walls of which were completely adherent to the adjacent tissues.

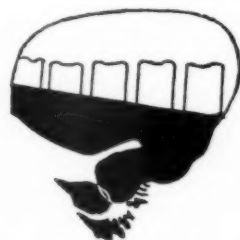


Fig. 3. Pyloric part and duodenal cap of an enterostomized stomach without ulcer found in the right lateral position.

passage through the anastomosis is slow or because he has swallowed the opaque mass very fast, the weight of the fluid column will give a hydrostatic pressure, causing discharge through the anastomosis. Usually we observe, that the speed of the discharge diminishes, when the level of the fluid is sinking; hence we may conclude, that the rate of the discharge depends on the weight of the column above the opening. Sometimes I found half an hour after the opaque mass had been taken, that the barium was in level with the opening, but an intermediate layer reached at the gasbubble; so it appears not to be right to conclude that if the opaque meal is passing freely through the anastomosis, less heavier contents, even when fluid, will pass in the same way; it seems to occur, that for discharge through the stoma a pressure is required, that is afforded by the heavy bariummeal, but not by the less heavier intermediate layer, consisting of secretion.

The gastric contents beneath the level of the anastomosis cannot leave in standing patients by gravity, yet they are discharged, so we

must consider, what other expulsing forces may do. In the normal stomach peristalsis and general tonic contraction are active forces in the discharge; when the wall of an enterostomised stomach is not damaged by an ulcer, both peristalsis and tonic contractions may cause a movement of the contents upwards, so that they may pass by the opening; this however does not occur to such an extent, that it is readily observed during fluoroscopy; only by examinations at frequent intervals we state, that gastric contents diminish; hence we may conclude, that a discharge by active forces of the gastric muscles must occur.

Examination of the discharge in diseased non-operated stomachs taught us, that an ulcer of the lesser curvature of the stomach is an impediment for the good function of the gastric muscles; also an inflammation in the surrounding tissues may result in a defective muscular action and be the cause, that a stomach without a pyloric obstruction has not discharged all barium mass after six hours. As in enterostomised stomachs most often some pathology will be present, we may expect, that even when the anastomosis is easily passed, a residue after six hours will be found. In a large part of the patients examined I really found small deposits between the folds of the greater curvature, sometimes even larger residues with a level, indicating the presence of an intermediate layer at the same time. It seemed to me, that there is no relation between the speed of the discharge during the first moments after the patient has taken his opaque mass and the possibility of emptying the stomach completely; the presence of a well situated and easily passed anastomosis does not warrant a complete discharge. For the movement of contents beneath the level of the opening a perfectly working peristalsis and general contraction seem to be necessary, and these are only found in stomachs without an ulcer and without an inflammatory process in the surrounding parts. In most enterostomised stomachs these conditions fail, so it seems to be somehow accidental, whether a perfect clearance will occur. I examined e. g. a patient with a duodenal ulcer and found, that the stomach, before the operation emptying completely, after the operation retained after six hours a little barium between the folds of the greater curvature; here the operation must have caused an adhesive inflammation and an impairment of the gastric muscles. (Case nr 2.)

Pyloric passage: In the non-operated stomach gastric contents pass through the pylorus, when the pyloric sphincter is opened and a motive power is present. In every healthy stomach and also in diseased stomachs without a spasm or obstruction of the pylorus, the sphincter opens a few moments after the filling has begun and so pyloric passage is seen. In enterostomised stomachs pyloric passage may be

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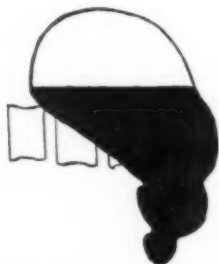


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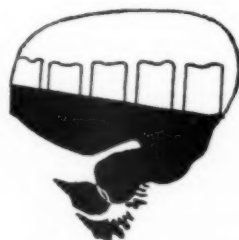


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expected to depend on the same conditions; so it should always occur, if the pyloric part is well filled, the level of the contents is above the pylorus and when no cause for pyloric spasm exists. These conditions being present pyloric passage never fails to occur; I observed it always in those stomachs, that had been operated without an ulcer found and also when the ulcer was situated in the upper part of the lesser curvature; only when an ulcer in pyloric or duodenal region was present, pyloric passage did not occur in such a regular way; sometimes it was readily seen, sometimes no passage could be stated. This observation will not surprise when we know, that in the non-operated stomach such ulcers may cause a permanent or an intermittent pyloric spasm thus interfering with the discharge.

When in standing patients hydrostatic pressure at the level of the pylorus is failing, pyloric passage does not occur spontaneously; no more it is seen, when the level of the opaque mass has sunk beneath it, either because a non-opaque residue cannot be removed, or because adhesions interfere with the filling of the pyloric part. In such cases absence of pyloric passage in the vertical position is easily understood. But when this class of patients is examined in the right lateral position or lying prone things are quite different; then gastric contents use to fill the pyloric part widely, the pylorus being the lowest part; a hydrostatic pressure being always present, in every patient discharge through the pylorus should occur (fig. 3). I really observed pyloric passage in these positions very easily and therefore it is justified to expect it with so much probability, that it is to be considered as some pathological sign (spasm or obstruction) if in any case examined it does not occur.

The passage through the pylorus in enterostomised stomachs thus is a problem, that is not so capricious, as might be concluded from different papers; it depends on several conditions amongst which the position of the patient, the site of the pylorus, the filling of the pyloric part and the rate of the discharge through the anastomosis are the most important; when the examination is carried on along proper lines pyloric passage must be observed unless an ulcer is still present and by a reflexmechanism is acting in an inhibitory way on the opening of the pyloric sphincter.

Secretion: It is always a difficult thing to judge the amount of secretion, because the intermediate layer is partly due to the gastric juice and partly to the fluid of the opaque meal after the barium has begun to sink. Nevertheless the intermediate layer gives some idea of the secretion and as in proper cases, where the stomach is not emptying quickly, the intermediate layer develops in the same way as in the normal stomach, we may conclude, that the secretionprocess after the opera-

tion does not change, this layer being found in both cardiac and pyloric parts above the opaque mass. In some cases the amount of secretion was decidedly large, then a duodenal ulcer could be demonstrated. In the preceding part already the fact has been mentioned, that the intermediate layer may attain a level high up above the anastomosis, even when the opaque meal passes through the opening very soon; the difference may be attributed to the weight of the bariumsulfate. So a well situated and open anastomosis does not warrant a perfect drainage of the gastric juice.

Adhesions: These form after gastroenterostomy in such different places, that no definite rule can be given. Two types may be found: adhesions of the gastric wall with the adjacent tissues and definite bands. Both types represent themselves in different ways: bands cause such a local irregularity of the greater curvature, that it takes the form of a garland; adhesions of the gastric wall with the surroundings interfere with the mobility, when the patient is in the lateral position. I never observed adhesions delaying the opaque mass to fill the cardiac part in the usual way, but often the pyloric part is concerned; then not only the filling but also the clearance is defective, the cause being partly a mechanical one, partly a reflective inhibitory action.

Description of Some Special Cases

To what extent do conditions of ulcers change, when a gastroenterostomy has been performed? We cannot foresay this change in a general way, as it will depend on the site of the ulcer and its peculiar spastic symptoms, as well as of the site of the anastomosis. I will therefore consider the problem in some special cases.

1:0 Mr W. was examined Dec. 1922 and a niche of the lesser curvature found visible only in the oblique prone position; there was considerable shortening of the lesser curvature and deep circular spasm opposite the niche. A year afterwards the shape of the lesser curvature remained the same, the circular spasm has slightly diminished, the niche cannot be made visible. The opaque meal is first filling the upper sac and passes slowly into the lower part; the pylorus opens without delay, the duodenal bulb is continuously well filled; no residue after six hours. At operation a little afterwards an ulcer is found, the gastric walls well relaxed, no shrinking. X-ray examination 10 days after the operation shows the hourglass-stomach in exactly the same way as before the operation; the narrow part between upper and lower sac as narrow as before; the opaque mass passes equally well through the anastomosis as through the pylorus; the upper sac does not empty in an appreciable extent faster as before. Half a year afterwards the shape of the lesser curvature is still the same, the circular spasm has diminished, the communication between upper and lower sac is slightly broader (Fig. 4). No complaints. A year after the operation the circular spasm is still present, but the communication between both sacs has widened still more; although the patient

again has some gastric complaints. The anastomosis and the pylorus are passed both; no residue after six hours. In this case the anastomosis did not change the gastric conditions in an appreciable way; after the operation the whole meal still had to pass along the ulcer; only the drainage of the lower sac must somehow have been accelerated and therefore the rate of the discharge of the upper sac perhaps at the same time. So the spastic stimuli given by the ulcer seem to have diminished,



Fig. 4 a.

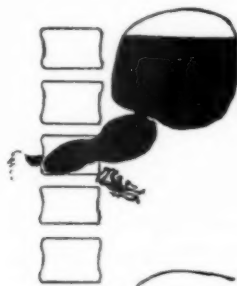


Fig. 4 b.

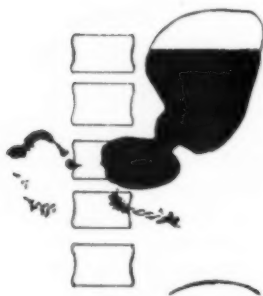


Fig 4 c.



Fig. 4 d.

Fig. 4. High situated ulcer: hourglass-stomach. a. before the operation; b. 10 days after gastro-enterostomy; c. 6 months after the operation; d. one year after the operation: hourglass-spasm diminished but still present; discharge both through anastomosis and pylorus.

they did however not change in a way, that the spasm stopped and so the ulcer must be supposed not to have healed; the patient however has no severe trouble.

2:0 Mr U. was examined June 1924 and a spastic deformation of the lesser curvature found close to the pylorus, niche-shaped, accompanied by a circular spasm and shortening of the lesser curvature between gastric angle and pylorus. The pylorus was readily passed; peristaltic waves stopped before the pyloric part; no residue after six hours. He was operated, an ulcer found and an anastomosis was made. Two months afterwards X-ray examination shows the anastomosis at the lowest part of the greater curvature, 6 cm before the pylorus, passed in an

intermittent way, but not very fast, after three quarters of an hour still a large opaque mass being in the stomach and a high intermediate layer above it. The pyloric part becomes in the vertical position poorly filled, tube-shaped, the niche not well to be distinguished; in the oblique prone position the pyloric part is not better filled, tube-shaped, with well defined contours, showing an unusual form that is recognised to be a spastic deformation as the normal pyloric lining is failing (Fig. 5). While standing no pyloric passage is observed, when lying down the opaque mass moves well into the duodenum and the cap is filled in about the usual way. Peristaltic waves start in the upper part of the stomach above the anastomosis, nearly segmentating, but stop in the pyloric part. After six hours nearly the whole opaque meal has passed into the intestine, but a few rests remain between the folds of the greater curvature.

In this case the spastic symptoms caused by the ulcer after the operation remained nearly the same. The pyloric part contained opaque mass during the whole time of the examination, thus the ulcer was permanently in contact with gastric contents. While lying down the passage through the pylorus along the ulcer went on in the same way as before the operation, only while the patient was standing gastric contents did not move along the ulcer, were only in contact with it.



Fig. 5a.



Fig. 5b.

Fig. 5. Praepyloric ulcer; a. before the operation in the vertical position; b. 6 months after the operation: spastic deformation of the ulcerarea, the duodenum is filled: prone position.



Fig. 6. Duodenal ulcer 5 years after gastroenterostomy: in the right lateral position the pylorus is well passed, the cap filled with deformity indicating ulcer.

Before the operation the stomach discharged the whole meal, afterwards it was no more capable of moving the few rests between the folds of the greater curvature, the motive function thus was slightly damaged. The gastric secretion was not less as before, did not pass the anastomosis quite so easily as the opaque meal did, and thus was in contact with the ulcer during at least the same time as before. So the conditions of the ulcer had not been changed by the operation in an appreciable extent; however the patient had been released of his severe trouble and gained weight.

3:0 Mrs S. had been operated August 1918 and was not examined by me before operation; at the operation adhesions at the duodenal bulb had been found, no ulcer; an anastomosis had been made. In March 1923 at X-ray examination a long stomach is seen with a poorly filled pyloric part; the opaque meal passes through the anastomosis, that is situated close to the lowest part of the greater curvature and in the beginning of the examination while the level in the cardiac part is high, the pylorus too is passed in a narrow stripe. In the right lateral position the stomach does not move; the pyloric part is well filled and the pylorus continuously passed; the duodenal bulb has well defined contours, showing a deformity typical for ulcer (Fig. 6). After six hours the stomach and the cap are empty.

In this case the anastomosis accelerated the discharge of the gastric contents and the ulcer was not passed, when the patient was in the vertical position; but when lying on her right side the pylorus proved to be open continuously and the bulb was filled just in the same way as when no operation had been performed. This patient was examined, because she still had some gastric trouble, but it was not so severe, that she wished to have recourse to resection; the form of the duodenal bulb however is to be regarded as the result of continuing spastic deformation and so we must suppose, that the ulcer had not yet healed.

4:0. Mr. G. is examined April 1924; he has a normal stomach, the cap is sometimes well filled with rather smooth contours, but always empties very soon, a few barium remaining with always the same shape, that is explained as a spastic deformation caused by a not-indurated ulcer. At the operation a small induration is palpated, that may indicate a small ulcer. Two months afterwards X-ray examination shows the anastomosis at about the lowest part of the greater curvature; it is passed rather fast, so the pyloric part does not fill well in the vertical position. In the oblique prone position it does not fill much better, but enough for allowing pyloric passage, if the sphincter should be open. But during the examination no pyloric passage can be observed, so we may safely accept a spasm of the sphincter to be present.

In this case the result of the operation is that no gastric contents pass the site of the supposed ulcer, neither in the vertical, nor in the prone position; all contents leave the stomach by the anastomosis. The patient has been relieved from his troubles but the failing pyloric passage must be interpreted thus, that the spastic symptoms of the ulcer have not yet disappeared.

Conclusion: Theoretical considerations of the ulcerhealing-problem will have to account for four definite observations:

- 1) Ulcers may increase in the non-operated stomach.
- 2) Ulcers may heal in the non-operated stomach, while at the same time other ulcers form; this has been beautifully described by SCHINZ (Fortschr. Röntgenstr. Erg.-Heft 34 p. 154).
- 3) Ulcers may heal or at least diminish in a short time after gastroenterostomy as I was told by surgeons, who occasionally had an opportunity of controlling the healingprocess at a second operation a few months after the first one.
- 4) Ulcers may continue after gastroenterostomy.

Apart from the ulcerhealing-problem one has to consider that of the benefit, patients use to have of an anastomosis. My observations show, that conditions after the operation do not change in a very simple way. Really in cases, where a shrinking in the pyloric or duodenal area or where a spastic obstruction of the pyloric sphincter existed, the change of conditions is obvious; but in all cases of the four types described above, without an impediment for the discharge, it is not clear, what may have stopped the distress. One cannot explain the good results by the fact, that now all contents pass by it and leave the ulcer untouched; in patients with ulcers of the upper part of the lesser curvature this cannot be true, and in those of the pyloric and duodenal

area food passes in the lateral and in the prone-positions just in the same way as when no operation had been performed. Neither it can be stated, that the clearance of the stomach has been accelerated by the anastomosis; certainly the larger part of the contents is leaving the stomach sooner as before, but part of them, filling the stomach beneath the level of the anastomosis, does not leave in a short time; sometimes (case nr 2) it was found, that even the motility was interfered with and the contact of the ulcer with the food lasted longer than before. The spastic symptoms of the ulcers remain, they may diminish but do not change in an important degree; never I could establish the fact, that after gastroenterostomy spastic ulcersymptoms failed, a few cases excepted, and in these at the previous operation no ulcer had been found. Also changes of the peristalsis and of the secretion are not observed in such a way as may be expected to be of definite value. One might perhaps be inclined to attribute some importance to the fact, that changes of the volume, and therefore changes in the tension by the weight of the contents, usually have been reduced; this however only may be true for gastric ulcers and even then such changes cannot be regarded to be important, as ulcers are protected against these forces by spasm of the surrounding parts of the gastric wall (spasm of lesser curvature and niche-spasm). So the critical analysis of the observations made does not enable us to explain the good results, that usually are observed. The only thing we have seen is that gastroenterostomy is an operation, that does not give uniform results. It seems to be impossible to foresee the result of an operation planned; not only the site of the ulcer and its peculiar spastic symptoms must be considered, also factors that cannot be foreseen, as the forming of adhesions, are decisive.

Appendix

Besides the ordinary type of anastomosis I examined two patients in whom a Finney-anastomosis between stomach and duodenum had been made; in both the results of the operation, in the beginning rather good, turned worse after some time and so a new examination was required.

One patient had been operated before three years, as an ulcer had been diagnosed (no X-ray examination), but at the operation no ulcer could be found; then the Finney-anastomosis was made. My examination showed a large ulcer-niche of the lesser curvature and at the operation (resection) the ulcer was easily found, so the conclusion seems to be allowed, that before three years only a superficial ulcer existed, that could not be palpated and that it developed gradually into a callous ulcer. In screening I found a broad circular spasm of the greater curvature and a shortening of the lesser curvature in such a way, that the gastric angle had

disappeared. The exit of the stomach was wide, easily passed, as well spontaneously as by palpation. The greater curvature showed a large fold due to an adhesive band. Peristaltic waves travelled at both curvatures below the ulcer in the normal way, only the forming of the antrum being defective as the anastomosis had disturbed the greater curvature. In spite of the wide exit and its low site and of the rather good peristaltic waves, after six hours a large residue was found. The ulcer was during all the time in contact with the gastric contents, so we might suppose a vicious circle to have existed: the ulcer by reflectory inhibition of the gastric muscles made the complete clearance impossible and the incomplete clearance prevented the conditions to be changed in such a way that the ulcer might heal. So while the Finney-operation succeeded in giving a good exit, the result was bad, as the muscular wall did not obtain by it a better function.

The second case shows about the same conditions; here 10 years ago the patient has been operated, while an ulcer was diagnosed, but it could not be found. The X-ray examination showed that the Finney-anastomosis gave a wide exit, that was easily passed by the opaque meal; but this wide exit proved to be insufficient for clearance, active assistance of the gastric muscles being wanted, but absent; at the lesser curvature a niche was found, that may be accused for the defective muscular action. Also in this case the exit was wide but could not ameliorate the gastric function as the function of the muscular wall is more important for clearance as a wide exit. This patient has not yet been operated a second time, so the findings have not been verified.

Both cases are published, because they are of the same kind as the gastroenterostomy-cases; notwithstanding the successful operative results the ulcer was not influenced in a favourable way and grew worse; it changed from a superficial ulcer of the mucous membrane into a deep callous ulcer.

SUMMARY

An analysis has been given of conditions found in enterostomised stomachs. It has been found, that the operation diminishes the mobility, but does not change the possibility of peristaltic movements and the pyloric mechanism. The role of both, however, depends on the extent of the discharge through the anastomosis, and on the position of the patient during the examination. In enterostomised stomachs ulcers go on producing spastic deformities of the gastric wall and hindering peristaltic movement; the enterostomised stomach with an ulcer therefore is different from the enterostomised stomach without an ulcer. The obvious result of the operation is the discharge through the anastomosis; it has been considered in what extent the conditions of ulcers have changed when this second way of discharge is present, but no definite change could be found; so the benefit patients usually have, cannot be well explained.

ZUSAMMENFASSUNG

Verfasser analysiert die in Magen nach Gastroenterostomie vorgefundenen Verhältnisse. Es zeigte sich, dass die Operation die Mobilität herabsetzt, aber



Fig. 1. En-face projection of anastomosis, showing that the direction of the folds of the mucous membrane has not changed from the normal.



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keine Veränderungen betreffs der Möglichkeit peristaltischer Bewegungen und betreffs des Pylorusmechanismus hervorruft; ihre Bedeutung hängt indes von dem Ausmass der Entleerung durch die Anastomose ab und von der Lage, die der Patient während der Untersuchung einnimmt. Nach Gastroenterostomie bleiben Magengeschwüre einen Reiz zu spastischen Wanddeformationen abgeben, wie auch ein Hindernis für die peristaltische Bewegung verursachen; in dieser Hinsicht besteht also ein Unterschied zwischen enterostomierten Magen mit und ohne Ulkus. Das am meisten auffallende Resultat der Operation ist die Entleerung durch die Anastomose; Verfasser hat die Frage zu beantworten versucht, in welchem Ausmass die Bedingungen für die Ulzera sich änderten, wenn dieser zweite Weg der Entleerung vorhanden ist, konnte aber keine bestimmte Veränderungen finden. Der Nutzen, welchen die Patienten gewöhnlich von dem Eingriff haben, ist also nicht gut zu erklären.

[RÉSUMÉ]

L'auteur donne une analyse des constatations faites sur des estomacs ayant subi la gastro-entérostomie. Il a été observé que l'opération diminue la mobilité sans toutefois apporter de modification aux possibilités de péristaltisme ou de mouvements pyloriques. Le rôle de ceux-ci dépend d'ailleurs de l'étendue de l'évacuation à travers l'anastomose, et de la position du malade au cours de l'examen. Dans les estomacs ayant subi l'entéroanastomose, la présence d'un ulcère détermine des déformations spastiques de la paroi stomacale qui sont un obstacle au péristaltisme; aussi un estomac entéroanastomosé *avec* ulcère diffère-t-il d'un estomac entéroanastomosé *sans* ulcère. Le résultat manifeste de l'opération est une évacuation de l'estomac à travers l'anastomose; on a recherché dans quelle mesure l'évolution de l'ulcère était modifiée par la création de cette seconde voie d'évacuation, sans avoir pu établir de différence notable; en sorte qu'il est difficile d'expliquer le bénéfice qu'en retire le malade.



SOME CASES OF PULMONARY ATELECTASIS

A Casuistic Communication

by

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(Tabule XX—XXI)

On a complete obturation of the bronchial lumen a resorption atelectasis arises in the parenchyma of the lungs consisting, as the name indicates, in resorption of the remaining air and collapse of the parenchyma. The obturation may be due partly to an inhaled foreign body or a tumour emanating from the bronchus, a gumma, etc., partly to a compression of the bronchial lumen by a tumour, an inflammatory gland, an aneurysm, etc. The large, continuous densities found in pulmonary anthracosis, especially in the upper portions of the lungs, have also been interpreted as atelectatic areas originating from an obturation of the smaller bronchial lumina by accumulation of excretion and inhaled coal-dust. According to the situation of the obstacle in the bronchial tree this atelectasis commences in separate parts of the lung: is the obstacle in the main bronchus, a complete collapse of the entire lung will follow, and if it is in one of the bronchia leading to the lobes, lobar, or smaller, atelectatic portions may result. Is the obstacle incomplete, it happens that the air passes in but not out — valvular obstacle —, and an emphysema ensues. This is, however, usually accompanied by a secondary atelectasis as a result of the occurring infection and the stagnated secretion, which fills the alveoli, a condition called »obstructive emphysema».

The roentgenological phenomenon appearing in connection with the atelectasis is in the first place an increased density in the affected portion of the lung field on account of the reduced quantity of air. In the cases examined it has not been possible to ascertain how soon this haze appears, neither are there any data of this in literature as, with the exception of the investigations of LICHTHEIM in

1878, it has not been possible to find any, and no roentgenological experiments are published on it. Nor are there any data of the time required by the lung to dilate completely after removal of the obstacle. KOFLER has, it is true, mentioned a case in which the lung had »developed» completely after three months, but he does not say whether the disappearance of the atelectasis was observed successively by means of X-rays. The density thus arising may become so pronounced that every lung marking disappears, and the aspect may simulate a partial or total pneumonic infiltration. Has the lower lobe in either lung collapsed, the shadow of this coincides with the shadow of the diaphragm which thus does not appear, except possibly on the left side with the aid of the fornix gas bladder.

On account of the decreased volume of the lung and the negative pressure in the pleural cavity a displacement of the heart and mediastinum towards the side of the atelectatic lung takes place, being most marked in the parts where the mediastinum is least fixed. Simultaneously there is also a pulling upward of the diaphragm on the same side. These retractions may be increased later on with lasting bronchial obstruction caused by induration and shrivelling of lung tissue, which may reach such a degree that the heart and mediastinum shadows are completely merged in that of the retracted lung. According to JACOBSEN and HOLZKNECHT «an inspiratory dislocation of the mediastinum into the stenosed half of the thorax» may be seen, but according to GROEDEL this only takes place, when the stenosis has developed at a particularly high rate and the air quantity contained in the affected lung is not strongly reduced.

The decreased mobility in the affected half of the thorax, the contracted interstices and the slanting ribs, phenomena indicating a shrinkage of the thorax, may also be observed roentgenologically. On the healthy side, however, all changes indicative of a vicarious emphysema appear with sufficiently large atelectases. The differential diagnostic problems the roentgenologist has to face in these cases are not numerous, but they may instead be all the more difficult to solve. I quote MANGES: — »Differential diagnosis is immediately apparent because, in the vast majority of instances, effusions, consolidations, massive new growths, etc. produce displacements of the heart and mediastinum toward the unaffected side — just the reverse from atelectasis of the obturation type. In one of these conditions however, that of massive thickening of the pleura or extensive lung fibrosis following infection, the displacement of the mediastinum and the density of the shadows may resemble obturation atelectasis to such an extent that, from the roentgenograms alone, one cannot make the differential diagnosis and if the history is of the standing,

it may be difficult to differentiate between atelectasis of the obturation type and collapsed lungs or atelectasis due to compression or fibrosis. It deserves perhaps to be emphasized that an advanced tuberculosis of a productive type in which simultaneously severe pleuritic changes are present, ought to be able to give a similar roentgenologic aspect.

The most common cause of resorption atelectasis are foreign bodies inhaled into the bronchi. In a group of 25 such cases KOFER was able to show roentgenological changes in three, and of late MANGES has, at the radiologist congress in London in 1925, given an account of about hundred cases of foreign body in the lung with atelectatic changes. Similar observations are made by BOWEN, CHEVALIER JACKSON, RITWO, and others. The first of the present cases is also one of foreign body in the lung, where the roentgen-ray examination shows the typical features of a total pulmonary atelectasis with the obturating obstacle situated in the main bronchus on the right side and complete atelectasis developed in the lung apparently after not quite 24 hours. Afterwards the obstacle in the main bronchus has been loosened by the surgical manipulations, so that air has entered into the collapsed lung, and heart and mediastinum replaced in their normal position (v. figure 2). On account of a secondarily arising pneumonia the haze remained, however, over the previously atelectatic lung area.

Case I: 2574/18 Malte N., age 1, admitted Dec. 14. Accident during play.

In the evening of Dec. 12, the patient had a sudden fit of coughing and suffocation, during which he grew pale and cyanotic, according to the belief of the parents on account of a kidney bean gone down the wrong way. Then he had a quiet night, but the day after repeated fits of suffocation, and a doctor was sent for who made arrangements for roentgen-ray examination. Roentgen-ray examination (EDLING) 12. XII. 1918: A compact shadow throughout the entire right lung field. Heart and mediastinum displaced towards the left. On the left side no changes visible. No shadow of foreign body. — Diagnosis: Atelectasis of the right lung (evidently by obturation of the main bronchus), v. figure I. — Temp. in the evening 39°. Yesterday and to-day a. m. several fits of dyspnoea lasting 15–30 minutes. Admitted at 10 o'clock a. m.

Admissional status Dec. 14: Dyspnoea and rattling respiration. No cyanosis. Temp. 38° and pulse 130. Dullness all over the right lung, in the lower parts with a tympanitic nuance. 11 o'clock a. m. At 11 o'clock a. m. tracheotomy + inferior bronchotomy (HELLSTEN-TÖRNE): First an attempt was made with bronchoscopy, when the bean was found wedged into the right main bronchus sticking up past the bifurcation. When extraction was attempted only the rind and a small part of the interior came out, wherefore it was decided to do inferior bronchoscopy. Now it was discovered that the

remnants of the bean had changed their place and could not be found. As the patient threatened to stop breathing, bronchoscopy was discontinued.

On repeated roentgen-ray examination repeated bronchoscopy was done through the tracheotomy wound at 7 p. m. It was not possible to reach the bean, which however seemed to be dimly visible down in the bronchus of the medial lobe. The patient became however suddenly bad and ceased occasionally to breathe. Simultaneously an emphysema spread in the lower part of the throat, wherefore the operation was discontinued.

Bad after operation, breathing more and more difficult. Increasing emphysema on the throat, which diminishes on incision, but the breathing difficulties grow worse, and the patient dies at 9 p. m. Extract from autopsy:

— Throughout the anterior mediastinum a severe interstitial emphysema. The entire bronchial tree in both lungs filled with abundant amounts of very thin grey pus. In the right main bronchus, opposite to each other, two somewhat longish sores about 4 mm in length, one of which, situated in the medial wall, entirely penetrates the wall layers out into the mediastinum. Pneumonia in the entire right lung.

P. a. d.: Ulcera (decubitus?) rami primordial. bronch. dx. c. perforatione et emphysema interstitiale mediastini ant. + laryngitis fibrinosa + bronchitis diffusa purulenta + pneumonia dx.

SPIESS has described a case of severe dyspnoea originating from a polyp in the right bronchus, that was partly blocked up by it. In the upper and medial lobe dense areas could be observed roentgenologically, which were interpreted as a tumour. On extraction of the polyp and repeated roentgen-ray examination a shadow of the breadth of a hand is seen, which skirts the spine from above downwards and possibly should be interpreted as an atelectasis. »Probably the areas visible in the preceding examination have also been atelectatic ones.» Both ASSMANN and RIEDER-ROSENTHAL state, that lung atelectasis may be caused by obturation of the bronchial lumen in consequence of tumour. OTTEN has observed, in cases of tumour in the lungs, that the thorax in the vicinity of the infiltrated region shows obvious signs of shrinkage in the form of sinking in of the thorax wall, contracting interstices, etc., but he ascribes these changes to an obliterating pleurisy. Pleural changes are in no wise uncommon. This »pleurisy» does not, however, become an adhesive type, it is, on the contrary, characterized by an (extremely) labile exudate. These changes observed by OTTEN are more likely to be of an atelectatic nature.

The case described below shows a patient with lymphogranulomatosis (pathologic-anatomical diagnosis available), in which enlarged glands have compressed the bronchus leading to the upper lobe on the right side with collapse of this lobe as consequence. At the examination it was possible to follow the increasing collapse closely, as at the roentgenoscopy on April 9, the diaphragm stood high and the lower edge formed a concave, laterally downward slanting curve.

When the examination was repeated, this edge had changed its place and formed a line slanting laterally upward to I_2 and plainly discernible on the films that were taken. The swelling of the glands was reduced by X-ray treatment, and the supply of air to the lobe started but did not reach its full extent, some smaller, atelectatic areas remaining after the treatment.

Case II: 610/24 Dora E., Miss, female, single, age 30. Admitted April 4, 1924.

Hereditarily nothing of interest. No infantile diseases, but has always been healthy, with the exception of a period in the autumn of 1918, when she had the influenza. In connection with this she also had a sensation of a resistance in the throat when swallowing, a trouble which has now disappeared, so that the patient has felt quite well. At the end of February she noticed a node on the right side of the lower part of the throat. During the last few months she has felt somewhat out of sorts and tired in the evenings. Has grown a little thinner during the last few years. Has coughed during the last three weeks. The node has grown only a trifle. The patient has had neither swallowing nor breathing difficulties nor hoarseness. Never pains, has worked all the time. On April 4 the patient visited the out-patients' department of this hospital. The examination made there showed amongst other things: in the right fossa supraclavicularis a conglomeration of enlarged lymphatic glands, smaller ones in the corresponding place on the left side; no glands in the axils or inguina; some exophthalmos; fine-wavy tremor in the fingers.

Blood status: red blood-corpuscles 4 300 000, white blood-corp. 17 000, hemoglobin neutrophil leukocytes 87.5 %, eosinophil leukocytes 1 %, basophil leukocytes 0.5 %.

Large lymphocytes 1 %, small lymphocytes 6.5 %, monocytes 3.5 %.

Roentgenoscopy: In the right hilum a conglomeration of glands of the size of a mandarin extending into the posterior mediastinum. The upper part of the right lung area was not well illuminated. A Sternberg's disease was suspected, and therefore the patient was recommended to admission.

Status on April 7, 1924: General condition good. Flesh and muscles ordinary. Temperature subfebrile. Cor: Ictus in I_3 , not intensified, hardly reaching the unretroposed mamillary line. No fremitus. Slight pulsations. The left margin almost to the mamillary line. The right margin scarcely a finger-breadth on the right side of the right sternal edge. Sounds without obvious remark.

Abdomen soft and not tender. Liver and spleen impalpable.

Lungs: shorter sound on the right apex about down to the spine. The right apex: respiratory sound reduced, no râles. In both fossae supraclaviculares a number of not tender, fairly solid, isolated glands varying in size from a pea to a hazel nut. On the right side they are barked together into a conglomeration of almost the size of a mandarin in the lower part of fossa supraclavicularis, the single ones nevertheless being discernible. The skin over the glands quite movable. Glands also movable towards each other. In the axils and inguina are the glands hardly palpable, and not the cubital glands either.

Nervous status without remark.

9. IV. 24. The right base at the back $\frac{1}{2}$ A — B D_3 — D_3 . D_4 — D_5 from the apex and almost down to the spine. On the base above the dull region slight, rather superficial râles in inspiration and on coughing.

9. IV. Roentgenoscopy (KARL PETRÉN): The left lung field with the diaphragm and sinus free. The diaphragm is here very low. The apex of the heart displaced downwards and towards the left. The right edge of the heart about normal position. The right diaphragm 3 finger-breadths higher than the left. Sinus not free. Cannot decide, if the shadow of the soft parts is the cause. A haze covers the right lung field down to C_3 , on the whole homogeneous and limited at the bottom by a distinct outline which makes a downwards concave curve that slants downwards laterally. The medial shadow is considerably enlarged at the top. The left outline situated a couple of finger-breadths on the left side of the spinal shadow. Seems to correspond well to a vasal shadow. In oblique exposure the upper part of the "glade" not clear.

Roentgen-ray examination, 10. IV. 24 (EDLING-GARTHON): The right diaphragm is a large finger-breadth higher than the left, is mobile in respiration but makes obviously smaller excursions than the left. The right pleural sinus shows a slight, diffuse haze caused by a small exudate. The left pleural sinus free. The upper portion of the right lung field shows a homogeneous density with a linear limit at the bottom. This lower limit-line slants from the hilum region on a level with I_3 laterally upwards (v. figures III and IV) to the lateral part of I_2 . The said shadow cannot, on rotation of the patient, be projected free from the lateral thorax edge, and considering its appearance and limitation in other respects it may be due to a process restricted to the lobe. In oblique exposure a distinct haze over the posterior mediastinum. On the left side the vasal shadow continues upwards to the sternoclavicular joint as a vertical line. As to size and degree of density the left hilum shadow shows no certain difference from the normal. On account of the above-described haze only the lower portion of the right hilum shadow is visible. It is distinctly larger and denser than the normal. From the left hilum shadow several linear markings ascend towards the top of the lung field.

From a roentgenological point of view there is thus partly an obvious enlargement of the bronchopulmonary glands, partly a density localized to the upper lobe of the right lung and most probably caused by atelectasis.

Roentgenoscopy (K. PETRÉN): The shadow in the right upper lung area is now defined. At the same time it has become consolidated and cannot be distinguished from the mediastinal shadow. Its limit is now, as on the plate, formed by a downwards convex line.

Roentgen-ray treatment 11. IV. 24: $\frac{2}{3}$ H. E. D. — 30 ccm — 4 Al towards the right and left fossa supraclavicularis which I estimate to find at C_3 .

$\frac{2}{3}$ H. E. D. — 30 ccm — $\frac{1}{2}$ Zn + 1 Al towards the right side of the chest in front.
 " " " " " sternum.
 " " " " " right side of the thorax medially.
 " " " " " right side of the thorax laterally.
 " " " " " right axil.

Three areas a day and $\frac{1}{3}$ on each area a day.

16. IV. $\frac{2}{3}$ H. E. D. — 30 ccm — 4 Al towards the left fossa supraclavicularis and towards the right side of the chest in front.

Case III: Nils P., age 34. Admitted 25. VII. 25. 1237/25 in the medical clinic. Mother died of pulmonary tuberculosis at the age of 50. Father died of cerebral haemorrhage at the age of 75, brother died at the age of 19 of pulmonary tuberculosis. 8 brothers and sisters, healthy. The patient is unmarried. The influenza in 1921. Confined to bed for 6 weeks with pulmonary catarrh. Exempted from military service on account of a heart-disease which he was not aware of. Has never had rheumatic infection. Sometimes shortness of breath on physical exertion. About 14 days ago the patient got a cold with coughing. Did not take the temperature, does not think he had fever. The coughing increased by and by. Was however up and working, felt out of breath. On 23. VII. the patient felt tired and pulled down, so that he had to go to bed. No shivering-fits, no pain in the chest. On 24. VII. a doctor was called in who diagnosed pneumonia in the left lung. The temperature was then at noon 38.3°.

Admissional status: Considerably affected. Complexion hyperaemic, cyanotic. Worrying dyspnoea. No oedema. Coughs up thin, seromucous, colourless expectoration. Pulm.: Fairly close dullness over the upper portion of the left lung down to $\frac{1}{2}$ A₁ in the dull region sibilant bronchial respiration. Without coughing no râles over the right lung, no dullness. The percussion-note is here all over hypersonorous, the respiration sound somewhat harsh, no râles.

Cor: No real ictus palpable, but pulsations in I₄ and I₅ that do not extend past the left mamillary line. The left limit in I₅ is not to be determined on account of the ventricular tympany. In I₄ the limit is about 1 finger-breadth inside the mamillary line. The right limit does not overlap the right sternal edge. Frequency of heart 140/min. No arrhythmia. The pulse rather soft. The heart sounds without certain remark. Abdomen: 0. No hypertrophy of the liver.

Roentgenoscopy, 29. VII.: A diffuse, dense haze throughout the entire left lung area without mottled resolution. — General condition better. Slight coughing, fairly close dullness over the entire backside of the left lung. No râles.

31. VII.: Dullness less close below $\frac{1}{2}$ M. Bronchial respiration remains on the left ssp., for the rest no bronchial respiration. Without coughing no râles.

4. VIII. On the backside of the left lung a wooden dullness except in a region of the breadth of a finger close to the spine. On the apex bronchial respiration. Below $\frac{1}{2}$ M. considerably reduced, indistinct bronchial respiration. No râles. Whispered bronchophony somewhat reduced, pectoral fremitus suppressed. *The front:* Wooden dullness from sc₁ to I₄, where it clears up somewhat with the adjoining abdominal tympany. Bronchial respiration i sc₁ and I₁, reduced respiration below. No râles. Traube's chamber clear. *Cor:* No dullness outside the right sternal edge. The left limit in I₄ 1 fingerbreadth outside the mamillary line. Sounds without essential remark. Abdomen: 0. No glands in throat or axils. The patient is pale, somewhat cyanotic, dyspnoeic on motion. Prefers to lie on the right side.

Roentgen-ray examination 5. VIII. (JUNGHAGEN): The right sinus free and the diaphragm quite mobile. Cor and mediastinum considerably displaced towards the left, so that the spine is almost "laid bare". The left lung area is covered by a homogeneous, dense haze that does not allow any markings of lung to appear. The pronounced haze might of course depend upon a

large exudate, but considering the great shrinkage in the lung it depends probably on a carnification after a previous pneumonia (v. figure 6).

21. VIII.: Dullness all over the left lung at the back. The degree of the closeness very considerable on the lower half, very distinct also on the apex. The right limit of the dullness is a finger-breadth on the left side of the spine. The inspiration has a slight bronchial nuance (the expiration is not audible) but is smaller than on right side. On the right side the type of puerile respiration (increased functional claims).

27. VIII.: The general condition of the patient has improved the last few days. Had however at 11 o'clock a. m. a fit of dispnoea and collapse, cyanosis and unconsciousness. Did not come round. Mors at 3.30 p. m.

Autopsy (SJÖVALL): A man of ordinary frame. Usual cadaveric phenomena. On removal of the front sternal plate of the chest the left dome of the diaphragm turns out to be high, and the left lung is small and atelectatic, with wrinkled serosa but without other changes in the pleural sac which contains a moderate amount of serous fluid. The right lung is somewhat voluminous but otherwise quite normal. Pericardium without remark.

On subsequent removal of all the organs of the chest as a connected whole an aneurysm of the size of a large hen's egg is found on aorta situated at the isthmus and affecting the subclavian artery also. This aneurysm is lined with partly very loosely fixed thrombs, and the wall is for the rest uneven, rugged, and partly very thin. On cutting up of the oesophagus the aneurysm proves to be eating its way through the wall, and in looking down the uncut trachea one finds the posterior portion of its wall bulging like a truss pad into the lumen as a result of the pressure of the aneurysm. On cutting up of the trachea a marked narrowing of the left main bronchus is found at its starting-point, caused by the aneurysm, and the said bronchus is filled by a blood-coloured, very sticky, glassy phlegm. On cutting up one finds the wall damaged close to the aneurysm in an area of the size of a threepenny piece and fresh thrombotic masses bulging into the bronchial lumen.

On both sides of the aneurysm aorta shows only slight changes, and no ostium stenosis is present. The heart is normal.

Abdominal organs without remark.

P. a. d.: Aneurysma aortae et a. subclavias c. arrosione tracheo-bronchiali sin. et oesophagi c. atelektase pulm. sin.

The case illustrates excellently the truth of the statement of MANGES and the difficulty in distinguishing a pulmonary atelectasis with displacement of heart and mediastinum from a carnification of the lung with similar phenomena.

SUMMARY

The author gives an account of three cases of pulmonary atelectasis as a result of bronchial obturation:

1) Foreign body in the main bronchus on the right side with total atelectasis of the lung after not quite 24 hours.

2) Enlarged lymphogranulomatous glands compressing the upper bronchus on the right side with atelectasis of the upper lobe.

3) Aneurysm compressing the main bronchus on the left side with total atelectasis of the left lung.

All three cases show the characteristic roentgenologic changes with a haze over the affected lung field and shrinkage of the lung besides secondary shrinkage phenomena of the thorax and mediastinum.

ZUSAMMENFASSUNG

Verf. berichtet über drei Fälle von Lungenatelektase als Resultat von Bronchialobturation:

1) Fremdkörper im Hauptbronchus der rechten Seite mit totaler Atelektase der Lunge nach nicht ganz 24 Stunden.

2) Vergrößerte lymphogranulomatöse Drüsen, welche den oberen Bronchus der rechten Seite komprimierten, mit Atelektase des Oberlappens.

3) Aneurysma des Hauptbronchus der linken Seite mit totaler Atelektase der linken Lunge.

Alle drei Fälle zeigen die charakteristischen röntgenologischen Veränderungen mit Verschleierung über dem affizierten Lungenfeld und Schrumpfung der Lunge nebst sekundären Schrumpfungssphänomenen des Thorax und Mediastinums.

RÉSUMÉ

L'auteur raconte trois cas d'atélectasie pulmonaire comme résultat d'obturation bronchique.

1) Corps étranger dans les bronches capitales du côté droit avec atélectasie totale du poumon au bout de moins de 24 heures.

2) Une lymphogranulomatose étendue comprime les bronches supérieures du côté droit avec atélectasie dans le lobe supérieur.

3) Anévrisme comprimant les bronches capitales du côté gauche avec atélectasie du poumon gauche.

Tous les trois cas montrent le changement caractéristique roentgenologique avec nébulosité du champ pulmonaire atteint et atrophie pulmonaire s'accompagnant d'atrophie secondaire du thorax et du médiastin.

REFERENCES

- ASSMANN, HERIBERT. Klinische Röntgendiagnostik der inneren Erkrankungen, 1924.
- BOWEN, CH. T. Foreign bodies in the bronchus and oesophagus. Am. J. Roentgenology, 1922.
- BRÜNINGS und ALBRECHT. Direkte Endoskopie der Luftwege; neue Chirurgie, herausgegeben v. V. Bruns 1915.
- EDLING, LARS. Some Contributions to the Roentgenology of Pulmonary Anthracosis. Acta Rad. Vol. VI.

- EPHRAIM, A. Zur Frühdiagnose der primären Lungentumoren; Berliner klinische Wochenschrift 1912.
- GROEDEL: Lehmanns medizinische Atlanten.
- HOLZKNECHT, G. Die röntgenologische Diagnostik der Erkrankung der Brusteingeweide.
- JACOBSEN, N. Klinisch-experimentelle Beiträge zur inneren Medizin (Festschrift für Julius Lazarus 1899).
- KOFLER, KARL. Die in den letzten fünf Jahren an der Klinik gekommenen Fremdkörper des Larynx, der Trachea und der Bronchien. Wiener klinische Wochenschrift 1915.
- KONJETZNY, N. Über Fremdkörper in den Luftwegen. Inauguraldissertation 09.
- LICHTHEIM, N. Versuche über Lungenatelektase; Archiv für experim. Pathologie und Pharmakologie 1879.
- MANGES, WILLIS. Atelectasis as a Roentgen-Ray sign of foreign body in the air passage. Am. J. Roentgenology VI 1924.
- CHEVALIER JACKSSON, WILLIAM SPENCER and WILLIS MANGES. The diagnosis and localisation of non-opaque bodies in the bronchi; Am. J. Roentgenology 24.
- OTTEN, M. Die Röntgendiagnose der Lungengeschwülste; Fortschritte auf dem Gebiete der Röntgenstrahlen, 1910. Vol. XV.
- RIEDER-ROSENTHAL. Röntgenkunde 1925.
- RITWO, MAX. Massive collapse of the lungs; Am. J. Roentgenology, IV, 1924.
- SPIESS, GUSTAF. Ein Fall hochgradiger Dyspnoe infolge eines Polypen im rechten Bronchus: Münchener medizinische Wochenschrift Nr. 40, 1910.
- WEINBERGER. Bronchostenose infolge eines Aortenaneurysmas; Mitteilungen der Gesellschaft für innere Medizin und Kinderheilkunde in Wien 1906.



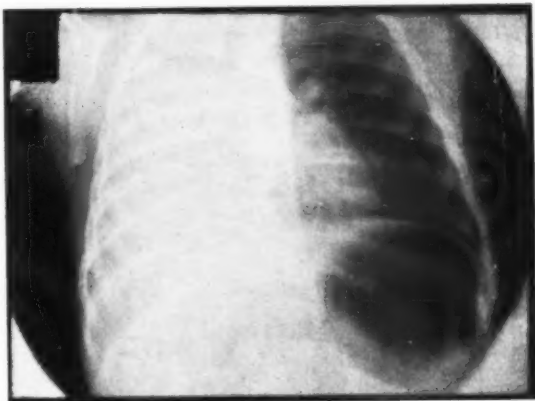


Fig. 1.

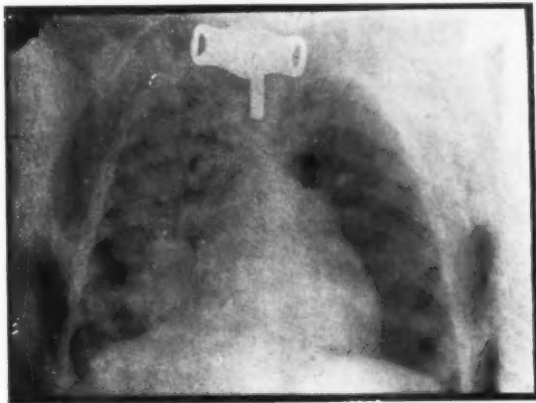


Fig. 2.





Fig. 4.



Fig. 6.



Fig. 3.



Fig. 5.



INVESTIGATIONS INTO THE EFFECTS PRODUCED BY "MALMSTRÖM'S COD-LIVER OIL WATER" WHEN AD- MINISTERED, THROUGH THE MOUTH, TO RATS SUB- JECTED TO A RICKETS-PRODUCING DIET

by

Eigil Rekling

In the recent number of these Acta,¹ MALMSTRÖM gave an account of his investigations concerning the photoactivity of irradiated oils, and described a preparation; the "cod-liver oil water", in which he believes to have found a substance capable of accelerating the healing of tuberculous foci, and apparently producing a distinctly noticeable analgetic effect, especially in cases of dysphagy and pleuritic pains. MALMSTRÖM obtains this preparation by irradiating cod-liver oil by means of a quartz lamp, afterwards adding to it distilled water and letting it stand for a certain length of time. After a while, the water will become yellowish and acid, owing to the various water-soluble constituents which it receives from the cod-liver oil. On chemical investigation it was found to contain free acids, two thirds of which were volatile, principally formic acid; and, in addition to these, there were non-volatile acids — probably higher fatty acids, aldehydes, and small quantities of hydrogen peroxide. To produce an effect, the preparation had to be administered subcutaneously; given through the mouth the effect was nil. Later, it has been shown, by MÖLLERSTRÖM,² that the supply of oxygen during the irradiation of the cod-liver oil, as well as the length of time during which the irradiation takes place, are factors that have a considerable bearing on the degree to which the acidity of the water is increased. When the water was separated from the mother-oil, the acidity soon became constant; while, as long as it was allowed to remain in contact with the oil, the acidity went on getting stronger all the while. Furthermore, the water seemed to lose its therapeutic properties rather soon, when separated from the oil.

¹ Acta Radiologica, vol. IV, fasc. 3. No 19. 1925.

² MÖLLERSTRÖM: Hålahult Sanatorium. Festskrift. 1925.

Inasmuch, now, as cod-liver oil is known for its therapeutic action both in rickets and in certain forms of tuberculosis, it seemed an interesting question whether those elements of the oil which are, thus, soluble in water, have any effect in rickets; and that, in connection with this question, a special interest would attach to an investigation of whether the oil-water, given by the mouth, would — on rats subjected to a rickets-producing diet — have the same effect of protecting them against that disease, as is possessed by cod-liver oil and other antirachitic agents, such as, for instance, by vegetable oils that have been exposed to irradiation with ultra-violet rays.

To that end, a number of young rats, each weighing from 30 to 40 grams, were put on McCOLLUM's rachitic diet (no. 3143), which consists of: wheat, 33 per cent.; Maizefloor, 33 %; whit-gum, 15 per cent.; gelatin, 15 per cent.; calcium carbonate, 3 per cent.; sodium chloride, 1 per cent.; plus distilled water. This is a dietary rich in calcium salts, but lacking phosphate, and rather deficient in A-vitamins also. The animals who were given cod-liver oil water were allowed to drink as much of that liquid as they wanted, but got no distilled water. The rats were kept on this diet for 30 days. During the whole of that time they were kept, two and two together, in small cages, in a dark room, at a temperature of 20° C. At the end of the 30 days they were killed and examined. The diagnosis: Rickets, was made on the basis of the following pathoanatomical findings: the "rosary", i. e. the row of beading at the junction of the ribs with their cartilages; in severe cases spontaneous fractures of the ribs combined with callus-formations; broad, uneven epiphyseal lines, and general softness of the bones. The examination of the tibia was done by longitudinal section. Since it has been proved by IVERSEN and LENSTRUP,¹ as well as by HOWLAND and KRAMER,² that a lowering of the blood-serums content of acid-soluble phosphorus is an important sign of rickets, the blood of half the rats was examined, by KLEINMANN's nephelometric method,³ for the purpose of determining that content. The blood of the other rats was examined, for other purposes, with regard to its photoactive properties. With a view to ascertaining whether the length of time for which the cod-liver oil was irradiated, and the length of time during which the water was left in contact with the irradiated oil, would have any bearing on the result, two separate preparations were made, as follows:

¹ IVERSEN, P. and LENSTRUP, E.: Om Blodets Fosforindhold hos Smaabørn. 1920.

² HOWLAND, P. and KRAMER, B.: Journal of Diseases of Children. Vol. XXII, 1921, p. 105.

³ KLEINMANN: Biochemische Zeitschrift, 1919, 99, p. 115.

Cod-liver oil water I: a piece of gauze, of dimensions 25×50 cm., was made to absorb 35 c. c. of cod-liver oil, whereupon it was hung up and irradiated for 1 hour from a mercury-quartz lamp of 2.5 ampères, 160 volts, at a distance of 20 cm. After being thus irradiated, the gauze was placed for 2 hours in a dish containing 90 c. c. of distilled water. At the end of that time the water was drawn off and given to the rats. A fresh portion was made each day.

Cod-liver oil water II: Two squares of gauze, each measuring 50×50 cm., were made to absorb, in all, 100 c. c. of cod-liver oil, and were then hung up and irradiated for 32 consecutive hours with the light from the same mercury-quartz lamp, at a distance of 20 cm. They were then left to soak for 24 hours in 400 c. c. of distilled water, which was afterwards given to the rats. This portion would last for a week, after which time a fresh portion was made.

In order to find out whether the mere evaporations from the irradiated cod-liver oil would impart, to the distilled water, properties similar to those resulting from its direct contact with the oil, a third preparation was made, as follows:

Cod-liver oil water III: 35 c. c. of cod-liver oil, in a dish with a quartz cover, were irradiated for 2 hours, at a distance of 25 cm., with the light from the mercury-quartz lamp. The dish was fitted with two tubes, through which, during the irradiation, atmospheric air was, respectively, introduced and expelled, by means of a water-suction pump. The air, on entering, passed across the surface of the oil, and afterwards, together with the emanations from the latter, through 60 c. c. of water. A fresh portion was made each day.

The addition of 1 drop of ferric chloride solution turned all the preparations a brownish violet. This colour was strongest in preparation III; and was found, on measuring, to be proportional to the degree of acidity. The average figures were as follows:

<i>Cod-liver oil water</i>		I, per c. c.	0.2 c. c.	$\frac{n}{100}$	NaOH
—	—	II	—	2 drops	—
—	—	III	—	after 24 hours: 1.5 c. c.	—
—	—	—	—	2 days: 2.7	—
—	—	—	—	3 — 3.3	—
—	—	—	—	4 — 3.5	—
—	—	—	—	5 — 3.8	—
—	—	—	—	6 — 4.2	—
—	—	—	—	7 — 4.7	—

Of twelve young rats from the same litter, 6 were put on an unlimited supply of cod-liver water I, while the 6 others were used

as control. Of another litter, of eight young ones, 4 were given cod-liver water II ad libitum, while the 4 others were controls; and of a third litter, of six animals, 4 were given cod-liver water III; also ad lib., while the 2 remaining ones were used as control. The results will be seen from the following table, in which the degree of the affection — the rickets — is indicated, respectively, by: +++ (severe), ++ (medium), and + (slight); cod-liver oil water by: CW, and distilled water by DW.

Litter	Rat No.	Weight at beginning of experiment, grams	Weight at end of experiment, grams	Increase in weight, grams	Diet	Add. to diet	Rickets	Photo-activity of the blood	Inorganic phosphor in the serum milligrams in the hundred
1. IX/23 to X/23	1	38	63	25	3143	CW I	+++	—	
	2	27	47	20	"	"	++	—	
	3	35	58	23	"	"	+++		3.5
	4	34	59	25	"	"	++	—	
	5	39	71	32	"	"	+++		3.9
	6	36	62	26	"	"	+++		4.0
	¹ 7 (Control)	32	48	16	"	DW	+++		
	8 "	38	70	32	"	"	++		6.0
	9 "	40	75	35	"	"	++	—	
	10 "	30	52	22	"	"	+++	—	
	11 "	37	65	28	"	"	+		5.2
	12 "	29	60	31	"	"	+		6.1
2. IX/29 to X/31	13	32	62	30	3143	CW II	+++	—	
	14	33	71	38	"	"	++		5.2
	15	35	61	26	"	"	+	—	
	16	34	67	33	"	"	++		4.6
	17 (Control)	37	73	36	"	DW	+++	—	
	18 "	37	82	45	"	"	+++		4.1
	19 "	37	77	40	"	"	++		6.2
	20 "	35	62	27	"	"	++	—	
3. XI/3 to XII/3	21	58	75	17	3143	CW III	+++		3.2
	22	54	75	21	"	"	+++	—	
	23	48	63	15	"	"	+++		3.7
	24	56	78	22	"	"	+++	—	
	25 (Control)	50	89	39	"	DW	++		6.2
	26	49	78	29	"	"	++	—	

¹ Died the day before the experiment was finished.

Thus, all the rats were found to be affected with rickets. Ingested through the mouth, those elements of the cod-liver oil which are soluble in water possess no antirachitic properties. The necropsy, furthermore, showed that the rats who had been getting preparation III were the ones who had the rickets in the severest degree, and also that in nearly all the control animals the disease was of an almost uniform, fairly severe character. As regards the quantity of phosphor, soluble in acid, that was found in the blood-serum, it lay — in the case of all the control animals except one — between 5 and fully 6 milligrams; while in the case of the oil-water-fed animals the quantities were smaller, and smallest in those who had been getting preparation III, and who had the rickets in the severest form.

As a matter of fact, the quantity of acid-soluble phosphor in the blood-serum of young rats varies rather considerably, both according to the type of diet which is used to produce the rickets and according to the food on which the animals have been kept before being used for the experiments. At the laboratory of the Finsen Institute, both the breeding animals and the young ones that were afterwards to be used for the experiments have been kept on a fixed dietary, consisting of rolled oats, dried yolk of eggs, bone meal and fresh cabbage leaves or beets, and, in some cases, dried milk. For the young ones, the rations of bone meal and yolk of egg were shortened two weeks before the beginning of an experiment. On this diet — the purpose of which was to give sufficient A-vitamines at the same time as reducing the rachitic factor — SCHULTZER¹ had already found, in the course of his earlier experimentation at the Laboratory, that the amount of acid-soluble phosphor in the blood-serum of young rats was about 10 milligrams in the hundred. If the rats were subsequently made rachitic, by being put on McCOLLUM's diet no. 3143, and the resulting affection was in any way severe, the phosphor content dropped to about 5 or 6 milligrams in the hundred. The quantities found as a result of the present investigations are, thus, typically "rachitic quantities".

It is interesting to notice that both the severest development of the rickets and the smallest quantity of acid-soluble phosphor in the blood-serum was found in those rats to whom preparation III had been given; as the only difference between the latter and the two other preparations probably consists only in the greater acidity of no. III.

That the "cod-liver oil water" may act as an antirachitic if

¹ SCHULTZER. P.: *Comptes rendus*, vol. XCIII, 1925. p. 1008.

administered subcutaneously is possible; just as it is possible to imagine that a neutralisation of its acid contents would be necessary in order to produce the effect; but as far as I understand MALMSTRÖM and his collaborators it is precisely to the acidity of the preparation that they attach the very greatest importance.

SUMMARY

The attempt to prevent rickets from developing in young rats that had been subjected to a McCOLLUM's diet, no. 3143, by the administration, per os, of those elements of cod-liver oil that are soluble in water, have proved unsuccessful.

ZUSAMMENFASSUNG

Der Versuch, die Entwicklung der Rachitis bei jungen Ratten zu verhindern, welche eine McCOLLUM Diät Nr. 3143 unterworfen gewesen sind, durch Eingebung, per os, von solchen Elementen von Lebertran, die in Wasser auflösbar sind, hat keinen Erfolg gehabt.

RÉSUMÉ

L'essai d'empêcher le développement du rachitisme dans les jeunes rats soumis à un régime de McCOLLUM, n° 3143, en leur donnant, per os, de tels éléments d'huile de foie de morue qui sont solubles dans l'eau, s'est trouvé sans résultat (= inutile).



A METHOD OF MEASURING ROENTGEN RAYS, PARTICULARLY IN SKIN THERAPY¹

by

E. Björling

General Considerations

The object of this method, particularly intended for use in skin therapy, is to enable the operator to estimate a given dose of roentgen rays, with regard to quality as well as quantity, by a standard measurement that can be reproduced in different places.

The present methods in general use for skin therapy are stated in the literature to be: for the quality only informations regarding filters, for the quantity Sabouraud measures. These measures do not permit of exact reproduction in other places.

The following easily reproducible measures I have found useful: for quality: the half-value-thickness for absorption in aluminium or copper;

for quantity: 1 optic standard light (HEFNER).

The measurements are intended to be carried out with as little appareil as possible.

Principles of Quality Measurement

1.

If for practical purpose it is desired to estimate the quality of a roentgen radiation there are, as is well known, chiefly two methods to one's disposal for the present. These are: the measurement of: a) the spark-gap; b) the half-value-thickness.

2.

With regard to these two methods it should be noted that much more valuable informations are obtained by the measurement of the

¹ Read before the Swedish Society for Med. Rad. Nov. 28th 1925.

half-value-thickness than of the spark-gap, because the latter only estimates the quality of *one single point on the radiation curve*, viz. λ_0 , while, on the other hand, the *half-value-thickness* is a summarized measurement, an expression of the integral of the *whole curve*.

In addition to this, the spark measurement is unreliable also in regard to the single point λ_0 (with the same kilovolt, thus with the same λ_0 , the length of the spark varies not only with different electrodes and atmospheric conditions but also with different apparatus). For an exact measurement of λ_0 , it is necessary to use the spectrographic method.

3.

I am therefore of the opinion that in practice the *half-value-thickness should first of all be measured*.

4.

The meaning of half-value-thickness, however, must be *revised*. As used in the textbooks where it is meant to signify a reduction of the *intensity* to the half, this half-value-thickness cannot be measured *by any practical method*; this must therefore only be considered as a *theoretical expression*.

5.

I have therefore suggested the introduction of a new term, the *practical half-value-thickness*, by which I mean a reduction to the half, not of the intensity, but of something I call *effect*. My practical half-value-thickness can — contrary to the former — be *practically measured*.

6.

With the *roentgen effect in a certain substance* I mean the *result, produced by the radiation in that substance*.

The term *effect* can be best understood if we consider the inherent power of each radiation as comprised of a great number of different effectivities (possibilities) of which there is a separate one for each substance.

The difference in effect is dependent upon:

a) *different quantitative effect*, the difference varying according to the position of the *absorption-band-border* of the exposed substance (the band between the K- and the L-radiation); the quantitative effect is therefore different for biological, photographic and Sabouraud-material, etc.

b) *different qualitative effect*, for the effect may in some cases be *photo-chemical* (e. g. in biological or photographic material), in other cases of an *atmospheric-electric* nature (in air or other gases, thus in measurements by ionometer).

c) *different wave-length-effect* (the same amount of absorbed roentgen radiations varies in effect for different wave-lengths).

On account of these different effectivities the result of measuring the half-value-thickness in one given substance will be *different by measuring in different substances*.

(E. g. concerning a half-value-thickness in aluminium, one value is obtained when measuring photographically, another value when measuring ionometrically, one third value when measuring biologically etc.)

8.

Every statement about the practical half-value-thickness of a radiation must therefore include, not only the to the half reducing, but also the *measuring substance* (e. g. the half-value-thickness of 3 mm. aluminium, *measured photographically*).

My Method of Measuring the Practical Half-Value-Thickness

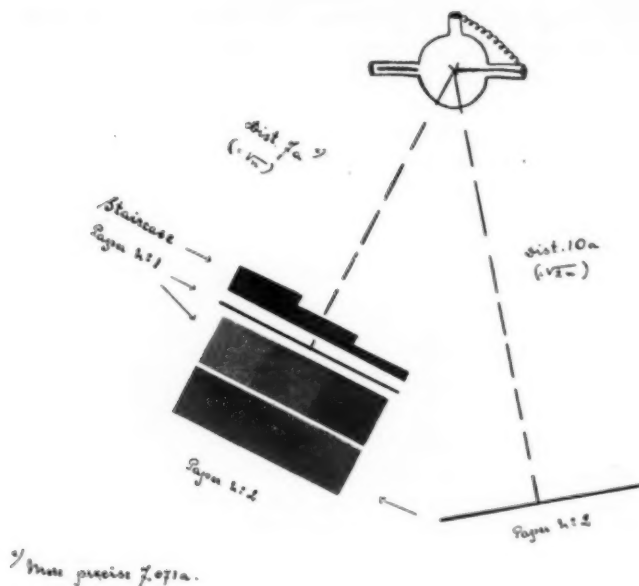
1.

Principle and some technical details.

Principle: Reduction to the half through absorption compared with reduction to the half through distance.

Technical details: One finds *that step* of an aluminium »staircase» (or one of copper, silver or bakelit) that has reduced *part* of the cone of rays through *absorption* to the same degree as *another part* of the same cone has been reduced from increase of the focal distance by $\sqrt{2}$ times that of the first part.

Measuring material: photographic paper (Artura Iris). Simultaneous exposure and subsequent simultaneous development of two papers, one (n:o 1) placed under the »staircase» and another (n:o 2) exposed at the increased focal distance. Finding the square on n:o 1 paper that has been blackened to the same degree (colour) as n:o 2; *the thickness of the step of the »staircase» corresponding to this square represents the half-value-thickness*. (Should the blackening correspond to an intermediate zone an average value is approximately calculated.)



2.

Preliminary results of the measurement of two roentgen apparatus with the above method.

G = Gastube worked by an apex-apparatus with medium voltage.
C = Coolidge tube worked by transformer with a maximum voltage of about 180 KV.

Half-value-thickness in millimetre.	G 0 filter	C 0 filter	G 2 Al	C 2 Al	C 4 Al	C $\frac{1}{2}$ Cu + 1 Al	C 1 Cu + 1 Al
in Al	$2\frac{2}{3}$	$3\frac{1}{2}$	$4\frac{1}{2}$	7	$7\frac{1}{2}$	> 9	> 9
in Cu	0.07	0.085	0.1	0.17	0.20	0.75	1
in Ag	0.05	0.055	0.07	0.09	0.11	0.20	> 0.25

The figures are approximate.

The most important points of these results are as follows:

- I. The figures are considerably higher than corresponding figures in the textbooks.
- II. There was great difference between the values obtained for the two tubes with the same filters (e. g. with 0 filter resp. $2\frac{2}{3}$ and $3\frac{1}{2}$ mm Al; with 2 Al resp. $4\frac{1}{2}$ and 7 mm Al).

- III. The half-value-thickness for tube C was only slightly increased on increase of the filters from 2 Al to 4 Al.
- IV. On increase of the filter from $1/2$ Cu to 1 Cu the value was considerably increased, both in Cu and Ag (thus $1/2$ Cu-filter produces no »practical homogenous» light).

My Method for Quantitative Measurement

1.

I employ as an *absolute standard* (reproducible in other places) *1 optical standard light* (HEFNER).

2.

Measuring material: The Hefner lamp being inconvenient to handle I have constructed an *electric standard-light-apparatus*.¹ The object of this is to produce in a sure and convenient manner the *photo-chemical effect of 1 standard light* (HEFNER) (as well as multiples and fractions of this) on the photographic paper it is desired to use. This standard-light-apparatus is therefore to be considered as a secondary Hefner lamp.

It consists of a small electric lamp (4V, 0.6 A) fed by an accumulator; the current can be set to a definite voltage through rheostat and voltmeter. By experimental testing of this voltage for each apparatus and accessory lamps, in comparison with the Hefner lamp, it has been so arranged that the *electric lamp produces*, on a given paper, the *photo-chemical effect of a fixed number of standard lights*. The lamps which should have been in active use some time before delivery give an absolutely constant light for quite a long time.

To absorb the desired quantity of light I make use of photographic paper; for this purpose a cassette is attached to the apparatus. The *distribution* of the optical light in question is effected partly through the lamp being *attached at various distances from the cassette* (from 5 to 12 cm.), partly through an arrangement by which, at the exposure, the lid of the cassette is not drawn out *all at once*, but in 5 stages, arranged in reference to time and length in such way that only the first part of the paper receives 100 % light, the 2nd part 67 %, the 3rd 45 %, the 4th 25 % and the 5th $12\frac{1}{2}$ %. By such arrangement a great number of doses of light may be obtained.

¹ The technical details of this apparatus are worked out by Preisler, Optician, Malmö, who also delivers such apparatus.

(My standard unit is 1 *opton* = the photographic effect of 1 Hefner light at a distance of 10 cm. during 1 minute.)

The photographic paper I utilize is generally *Velvet Green* (Kodak, Schwarzschild's exponent about 0.77); this paper has the remarkable property of not being blackened by roentgen rays but only by optical light. For very small doses I use *Artura Iris* (Kodak, Schwarzschild's exponent about 0.96).

*To enable a given dose of roentgen rays to be measured in the above units of optons its effect must be transformed into optical light. This is brought about by means of little fluorescent plates, containing calcium-wolframat (Kahlbaum-Folio, produced by the firm Kahlbaum on particular instructions.)*¹

3.

The practical mode of procedure in measuring.

A *measuring packet*, containing a fluorescent plate and a photographic paper (numbered), the latter being uppermost, is placed on the patient where it remains during the whole time of exposure.

After the interval of at least half an hour² after the end of the exposure one proceeds with the simultaneous development — in the same vessel — of:

- 1) all papers applied on the patients,
- 2) one or more strips of paper (from the same sheet as used in the »packet») exposed to the standard lamp at suitable distances.

By comparing the blackening of the papers in the »packets» with that of those exposed to the standard lamp we get for each dose of roentgen rays a certain measured quantity expressed in standard light units (optons).

Should the time of exposure be any other than 1 minute the resulting number of optons is corrected by the help of a chart supplied, calculated on the basis of Schwarzschild's exponent for the paper used.

¹ There is nothing new in comparing roentgen luminance with optical light for the purpose of measurement. This has been done before by BEHNKEN (Die Verwendung von Verstärkungsfolien zur photographischen Dosisbestimmung. Fortschritte. a. d. Geb. d. Röntgenstrahlen Bd XXIX, 3, page 330). — This is not the chief part of my method but the introduction of an absolute everywhere reproducible standard, viz. the Hefner light.

² In order to include the effect of »Nachleuchten» (delayed-lighting); the above mentioned time can probably be reduced.

4.

The advantages of this method as compared with that of KIENBÖCK:

- 1) Independence of time of development and quality of developer on account of simultaneous development of a known photographic effect (the effect of the standard light);
- 2) Independence of variations in the same quality paper on account of different deliveries (different issues) — the occurrence of which is well known — (the measurement being based on comparison of different exposed parts of the same sheet of paper);
- 3) The »silver-defect» does not exist here. The absorption band-border in my method (for tungsten at 0.17 \AA E) is present at each degree of penetration of the X-rays under examination, while that for silver (at 0.485) in KIENBÖCK's method is present with some filters and absent with others.

5.

The advantages of the method as compared with the Sabouraud-measurements:

- 1) A greater objective observation of the measurements;
- 2) The difference between small doses can be better observed;
- 3) The absorption-band-border is placed to greater advantage, with the result that, for the same biological effect, the difference between the reactions for very soft and very hard rays will be only 1:2 (approx.); while, on the other hand, the same reactionary difference with Sabouraud-measurements will be 1:4—6. The consequence is, that, for the same biological effect, a variation in the hardness of the rays does not alter the reaction as much with my method as with the Sabouraud-measurements.

My Measurements in Relation to International Measures

There should be no difficulty in translating the above unit of my measurements, optons for a certain half-value-thickness, into the international unit, 1 R, as soon this has been made practicable also for soft rays.¹

It will then be easy to settle, once and for all, the corresponding values of R units and optons for a certain half-value-thickness for which a table may be conveniently made up.

The capacity of the tube having thus been estimated in half-value-thickness and optons, such a table will give us further information with regard to the tube capacity measured in R units; one is thus able to know, at each radiation of the patient, how many

¹ R is so far only measured for certain hard roentgen rays (Deutsch. Med. Woch. 1925 No 24, page 998).

As he has received (as the measuring packet has been placed on the patient during the radiation).

One could then be spared sending one's ionometer to an »Eichstelle» for being read off.

DISCUSSION ON THE PAPER ON A METHOD OF MEASURING
ROENTGEN RAYS, PARTICULARLY IN SKIN THERAPY
BY DR E. BJÖRLING

DAG CARLSTEN: Although it is true that under certain physical conditions useful results may be obtained with photographic methods of measuring, yet we Radiologists feel an instinctive aversion towards them, ever since the downfall of the KIENBÖCK method. We know too well how unexplored a field the whole photographic process really is and how many factors there are that determine the blackening effect of light on a photographic medium. This applies to sunlight but in still higher degree to roentgen rays and the light from fluorescent screens. We need only consider the roentgen rays and their peculiar spectrum, the selective absorption, the secondary radiations, the scattered β -electrons, the variable intensification and the post-luminosity of the fluorescent screen. We suspect all these to invalve quite as many sources of error, difficult to control. Considering further, how troublesome and slow the photographic method practically is, we must have well-founded reasons or results of very particular accuracy to make us adopt new methods for old ones which have latterly brought us nearer the far-off goal: a reproducible exact method of dosage along the lines of the ionometer and the spectrograph.

The introducer has submitted a couple of photographic methods one of which is intended for quality measurement, the other for estimating the intensity.

With the permission of our Chairman I will deal with one at the time:

The idea with the quality measuring is briefly this, that we compare the reduction of light as the square of the distance in one cone of rays with the reduction through absorption in another and neighbouring cone. A photographic paper is placed under a »staircase» made of, say, bakelit, at a focal distance of \sqrt{a} cm. A control paper is placed lower down, at the side of the staircase at a distance of $\sqrt{2} a$ cm. Both papers are exposed simultaneously, when the blackening under a certain step will be equal to that of the control. The thickness of this step is the half-value-thickness and a measure of the quality of the radiation.

Several objections may be raised against this method of which I will now only deal with a few:

Firstly, one learnt already a long time ago that the so called half-value-thickness is not in any way a physical expression of a radiation, moreover, it does not even fulfill a modest claim of being a practically useful measure, a matter the originator himself, CHRISTEN, was quite clear about before he died. He had not reckoned with the secondary rays as a source of error. It is scarcely necessary to quote the results of KÜSTNER's investigations. He proves beyond doubt that roentgen radiations of different spectral width can have equal half-value-thickness. A statement regarding half-value-thickness, then, tells us really *nothing*, as suitable variations in voltage combined with different filters can give us almost any sort of half-value-thickness.

So much for the presupposition of the method. With regards to the new principle itself it does not seem quite certain that the light in the neighbouring cone of rays really is reduced as the square on the distance. This law is only applicable in the case of a pointed source of light and in our therapy we can scarcely reckon with this, owing to secondary rays from surrounding objects, rays that under conditions may be considerable enough. We must reckon with an additional »convergent» light from the anti-cathode, from the glass, the filter, the diaphragm, from surrounding objects, even the bakelit staircase itself and its understructure. These additional radiations falsify the facts and increase the blackening of the control paper and thus the figure for the half-value-thickness. (The introducer obtains, with his method, as you know, a figure for his half-value-thickness about 100 % bigger than other workers.)

The introducer may think this additional light may be neglected but we know from FRIEDRICH's investigations that even such a small matter as shifting the filter for a longer or shorter distance away from the measuring apparatus may make a difference in the reading of up to 15—20 %.

We know that the secondary rays may even, under certain conditions, be superior — in percentage — to the primary rays and we have in our daily practical work, a great and beneficial respect for their uncertainties. (Demonstration of films with strong secondary effects.)

We will now leave the control rays and instead deal with the »staircase», in which one of the cones of rays will be reduced through absorption. If we consider the problem in detail, it is easy to see that neither here must any additional light be allowed, that itself would blacken the underlying paper and thus at once lower the half-value-thickness. An understructure, emitting secondary rays, is thus unthink-

able or, at the least, extremely unsuitable. The half-value-thickness would then also vary according to the thickness of the understructure and the opening of the shutter.

But even assuming the »staircase» fleeting in the air it is nevertheless difficult to avoid the additional radiations. The »staircase» itself emits secondary rays and from above there will be »convergent» rays coming down from tube walls, filters, lead-shutters etc. Herein lies a source of error, the extent of which it is difficult to be certain about, as it is variable and inconsistent, but some idea of it may be obtained from the well known fact that, under certain conditions, the absorption in the first centimetres can be fully compensated by such additional radiations, indeed most unfortunate, the absorption being the very item we want to measure.

To this may be added the tendency of the photographic paper to be placed within the pathological luminous band — previously described by me — that is always found in the air between two media emitting secondary rays. The nature of the increased photographic effect of these luminous bands, not yet fully known, is probably due to secondary β -electrons, abnormally active. (Demonstration of pathological luminous bands).

It finally remains to point out that the light, that has passed through the »staircase», is no longer of the same kind as that effecting the control, because the former has become filtered on its passage through the »staircase» and is thus spectrographically different. It may be assumed from the difference in quality of the radiations compared, that the disastrous silver-error will be active through selective absorption.

On the whole then, we can agree to the considerable uncertainty attached to the theoretical considerations of the new quality measure.

For my own part I am a little sceptical about the practical usefulness of the method, not so much on account of the troublesome and drawn out management of it — which does not constitute a theoretical error and may possibly be simplified in time — but from the point of view of the principle itself, including, as it does, an irregular variation of a number of factors that have nothing to do with what is to be measured, viz. the quality of the radiations.

It is really astonishing that the introducer is unaware of the tottering ground beneath him, when he recommends the half-value-thickness as a measure of the ray-quality, a method discarded by the spokesmen for the physical and radiological sciences. Equally strange is his absence of regard for the additional secondary rays. Have we not seen examples of recent nature by our usual way of measu-

ring, to what gross errors the neglect of secondary rays may lead us? One would have expected him to have become at least somewhat dubious when, with his new method, he obtained 100 % greater values for the half-value-thickness than yet obtained by any radiological physicist.

It may be true that our present method of measuring quality is far from perfect, but still, we do have such fairly exact instruments as the spectrograph that automatically registers curves of the whole spectral field. We can also, apart from this, easily reproduce for practical purposes the quality of the radiation by stating the physical and radiological conditions under which a dose has been given. In such way we get relatively good informations about our roentgen rays and we get them without unnecessary waste of time, highly appreciated by us in practice who do not merely measure just for the sake of the measuring.

We must clearly reckon with errors but we master them fairly well, we are partly able to estimate them beforehand and sometimes we are even able to avoid them altogether. In the method advanced by the introducer all errors will be devoid of control.

I wish now to pass on to photographic *determination of the intensity*. I am not quite clear in my mind whether the introducer intends the method to be used in conjunction with the quality measure just criticized, for in that case one will naturally feel suspicious already at the start.

As we have heard, the method is mainly based upon a comparison of the blackening, produced by an intensifying screen and a normal blackening effect, (blackening scale) obtained by an ordinary optical light. We must first of all note here the additional subjective factor introduced in the matter of distinguishing different gradation. The blackening on the scale increasing in arithmetical progression, the dark fields will be difficult of being recognised the more numerous and darker they are. For WEBER'S law of sense impressions claims an increase or decrease of the blackening in geometrical progression to enable the difference in gradations in the beginning and the end of the scale to be equally comprehended. (Demonstration of blackening scales showing the uncertainty of the readings.)

In this relation a comparison with HOLZKNECHT'S pastils is near at hand. The introducer has most probably little faith in these and the subjective reading is undoubtedly a great drawback. Yet, with all their shortcomings they do have the advantage of giving an immediate record without the trouble of having to be put within protective papers before the exposure and without requiring development and fixation after this. They give an immediate answer, and

have shown since decades that their usefulness is, even, if limited, not yet at an end. Among the well known errors of the pastils is to be noted the selective absorption for barium-platinum. The intensifying screen does not as a rule contain these heavy metals, but, instead, another with specific absorption powers, namely Wolfram which, after all, comes to the same. I do not know whether the introducer understands me, when I question, whether he does not happen to register the defects of the pastils with his new method in addition to those of the intensifying screen and the photographic method, thereby forfeiting the only merit of the pastil, the immediate reading.

Be that as it may. A stronger objection is, that the light of the intensifying screen does not obey ROSCOE's law of reciprocity which says that the blackening will be the same, the product of intensity and time being constant. SCHWARZSCHILD's modification applies to the light from the intensifying screen which means briefly that a stronger intensity in itself gives a more pronounced blackening than a weaker intensity, active during a correspondingly longer time. It has been estimated by GLOCKER that an alteration of the intensity from 1 to 9 makes a difference of 20 % in the blackening, as estimated according to ROSCOE. A difference in intensity of 1:30 gives an error of 50 %. This applies to plates. SCHWARZSCHILD's law is said to be still more applicable to photographic papers. From this point of view the intensifying screen does not function satisfactorily knowing, as we do, how great are the variations in intensity in therapeutic work owing to high filtering, greater or lesser focal distance, stronger or weaker milliamperage etc.

I should now like to mention further a factor that is undoubtedly of importance but which lack of sufficient knowledge in physics prevents me from fully dealing with. It is the so called intensifying factor of the fluorescent screen that varies considerably for lights of different wave-lengths. The degree of blackening ought to vary much with change of quality of the light and I can imagine the possibility of misjudging the intensity on this account, the intensity also being recorded by the degree of blackening. In any case it seems to me the method claims absolute constancy of quality during the time of measurement which is not possible with the ordinary roentgen apparatus. Particularly is this the case, while the machine is set going, but also at other times. In this question, however, I should not like to be too definite.

Upon the post-luminosity, on the other hand, depends to a very great extent the existence of the method. We know from our diagnostical practice that all screens emit light after the exposure, not

to the extent of causing inconvenience in diagnostics but disturbing enough in therapy as will be seen from these films. (Demonstration of films.) The first of these films shows maximum blackening. It has been obtained by exposing one of our ordinary diagnostical cassettes *without* any films enclosed but *with* intensifying screens (no filter, one minute, 6 milliamperes, 170 kilovolt). 45 sec. after the exposure a film was put in and taken out again after 4 minutes. This maximum blackening is thus obtained by the post-luminosity of the intensifying screen, although the intensive radiation of the first 45 sec. has not had the opportunity of acting. The other film was enclosed in the same cassette, immediately following the removal of the first one, and was left there for 6 min. We can clearly see its blackening.

With our experience from the field of diagnostics we must now assume that the post-luminous intensity varies with the quality of the light. According to the part played by the post-luminosity this is very awkward for the new method, for the consequence will be that hard rays will always come to show increased intensity compared with the same quantity soft rays, particularly should one wait with the reading until the paper had had time to absorb most of the post-luminous radiations.

It must be further noted that the shorter the primary radiation, the more will the degree of blackening, and with this the dosage, be dependent upon the post-luminous radiation. But, the post-luminosity being to a certain extent independent of the time of exposure, it follows, there will be a considerable error in dosage, because there is much evidence to show that the post-luminous intensity will be about the same, whether the primary exposure be of longer or shorter duration e. g. a quarter of a minute or a whole minute. The consequence is, then, that the method will give abnormally high values for the short exposure, why it will probably be necessary to add to the above mentioned tables further corrections for time.

Much might still be added but what I have said may suffice. We can undoubtedly agree that the theory of the intensimeter is, to say the least, dubious. At any rate, the number of necessary correction tables are — if they permit a general arrangement — a troublesome complement. For my own part I have difficulty in believing that an improvement and simplification will be gained by elaboration of the method and I am therefore sceptical about the practical utility of this intensimeter for the future.

It must, however, be justly admitted that the method shows certain improvements as compared with the original dosimeter of KIENBÖCK. The silver error is eliminated as well as the usual error

in development. This was also the case with the very similar photographic method originated by the German physicist BEHNKEN, published a few years ago in Fortschr. a. d. G. d. Röntgenstrahlen Vol. 29 p. 330 and Vol. 30 p. 553.

The introducer now gives an account of »his method» without mentioning the works of BEHNKEN on the same subject. But is not the method of the introducer only a small modification of that of BEHNKEN? In the works of this author one also finds the blackening of the intensifying screen compared with the optical normal light which is, as we have seen, the central point in the method just related. They only differ in the way of production of the blackening scale. But BEHNKEN himself has evidently realized the uncertainties of this, already a long time ago, because he has recently, as we all know, adopted quite different principles with regard to the standardization of dosage. The introducer says that BEHNKEN has not put forth the principle of the optical normal light because »then this method should not include anything new». Clearly the introducer has not read the works of BEHNKEN. We read there (Fortschr. Vol. 29, page 331) word for word: »Der Kopierrahmen wurde nun dem Lichte einer 16-kerzigen Metallfadenlampe, deren Stromstärke genau auf 0,16 A. einreguliert war, in einem Abstände von 110 cm. genau 90 Sek. lang ausgesetzt. Diese Art der Belichtung diente bei allen Versuchen als Standard». Further on page 553 Vol. 30: »Von einem rechteckig geformten Stück photographischen Entwicklungspapieres (Gaslichtpapier) wird ein schmaler Randstreifen von etwa 1 cm. Breite eine bestimmte Zeit lang mit einer konstanten Lichtquelle belichtet um so eine Standardschwärzung zu erzielen». To anybody who can read, it would seem clear that it is BEHNKEN, not the introducer, who has introduced the optical normal light as a comparable measure in dosimetry.

But no dispute about this. It is the possibility of adopting the principle itself to the practical work we are dealing with, and it is in this respect I feel sceptical. I believe that the proposed methods, so far from helping us to arrive at some standardization of dosage, can on the most give us the semblance of exactitude and possibly make us believe that we work scientifically while we really are at loose ends.

ROLF M. SIEVERT: *Quality measurements.* Our knowledge of the relation between the wave-length of X-rays and the blackening of a photographic paper is very incomplete. It is most improbable that

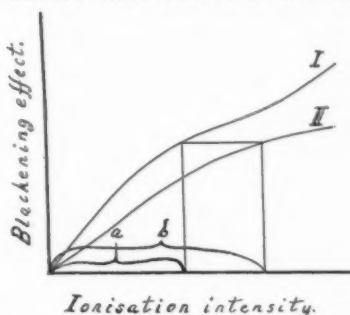
this blackening would be the same for equal intensities of different wave-lengths.

Let us make use of Dr. BJÖRLING's arrangement and measure the roentgen radiation in two ways. Supposing the time of exposure to be constant, let us then take one series of photos at different distances without a filter on the paper, and another set at a fixed distance but with different filters, i. e. under the »staircase». In both cases we measure the intensity simultaneously by means of an ionisation chamber. We then represent the results in the form of two curves (See fig.).

It is only with a very special composition of the X-rays or in case of their being monochromatic in nature that curves I and II will coincide. According to Dr. BJÖRLING we should commence with a given value for curve I, and compare the blackening there with that obtained for curve II at the »staircase». It is easy to see that the intensities under such circumstances will generally be far from equal (a and b in fig.), in other words it is not always the semi-value-thickness that Dr. BJÖRLING measures. The nature of the quantity measured will therefore vary with the difference in the composition (quality) of radiation treated. Consequently, it therefore seems as if one cannot attach any great value to photographic measurements of roentgen quality according to Dr. BJÖRLING'S method.

The estimation of quality by the length of a spark-gap is at least as reliable as the photographic method in question. The method proposed by Dr. BJÖRLING will surely involve errors of up to 50 % and more. If due regard is taken to the voltage curves with different roentgen apparatus there should be no difficulty in obtaining a more accurate quality value by recording the peak voltage by means of a sphere gap.

Quantity measurements. It is of course quite true, as Dr. BJÖRLING says, that the method of ionisation is defective in many ways. We must not, however, forget the facts on which this method is based: by making use of the effect in a substance of about the same atomic composition as the tissues in man, it is to be hoped that the biological effects will approximately follow the same lines as the intensities measured. The ionization method, in spite of its defects, does constitute a fairly convenient way of determining the relative intensity values.



I cannot, therefore, see that there is any reason for giving up this method for a photographic one which would certainly involve greater possibilities for errors.

Dr. BJÖRLING says that one of the advantages of his method is that the »Silver-defect» does not exist, and that the selective absorption by tungsten cannot cause any errors. This is absolutely incorrect, for just in skin therapy one often makes use of radiation lying in the tungsten K-region (70 kV.). It is therefore obvious that just in skin therapy the »tungsten defect» must cause great errors in results. The silver defect lying at about 25 kV. must always be present and consequently the silver defect is far less important when measuring therapeutic roentgen rays.¹

Test with photographic papers, carried out at the Stockholm University, show that the constant of SCHWARZSCHILD may vary from 0.6 to 0.8, depending partly on the developer and partly on the emulsion which varies considerably with different supplies of the same kind of paper. It would therefore be necessary to determine the constant for each packet used, a procedure causing both trouble and waste of time.

The effect which Dr. CARLSTEN calls the »pathological luminous bands» has reminded me of several statements concerning this question, I have come across in literature. For instance, it has been found in the case of radioactive bodies of prismatic shapes that the blackening effects at two boundary zones shows very peculiar irregularities. I think the following will explain these phenomena as well as those observed by Dr. CARLSTEN. Radiations can, on the whole, be divided into surface radiations, caused by easily absorbed rays, and voluminous radiations produced by rays of great penetration power. The first mentioned, i. e. the(?) or electron rays and the soft roentgen rays are responsible for the above phenomena. As those rays are quite likely to penetrate the black paper in which Dr. BJÖRLING puts the photographic paper, unforeseen errors may easily occur.

E. BJÖRLING: Dr. CARLSTEN states that the optical standard light has been used before this as a standard in the measuring of roentgen rays, viz. by BEHNKEN (l. c.), and that the quantitative part of my method would thus be the same as BEHNKEN's but »inferior to this».

On account of this I should like to state the following: I maintain what I have just said that the chief point in my quantitative method is the introduction of an *absolute* standard and by »absolute»

¹ Addition in the proof.

I mean that the optical standard light (HEFNER) remains the same in all places and is everywhere reproducible (in the same way as R is absolute as it will be the same everywhere).

With regard to BEHNKEN's method (l. c.) I also maintain that he does not make use of any absolute standard; his method is based upon quite a *temporary* measure that cannot be reproduced in other places.

In BEHNKEN's work (l. c. Fortschr. a. d. G. d. Röntgenstrahl. Bd XXIX, 3) we read on page 331, lines 9—11 from above:¹

»Der Kopierahmen wurde nun dem Lichte einer 16kerzigen Metallfadenlampe, deren Stromstärke genau auf 0.16 A einreguliert war, in einem Abstände von 110 cm genau 90 sek. lang ausgesetzt. Diese Art der Belichtung diente bei allen Versuchen als Standard.»

This is not, of course, any *absolute* standard (as is the case with the HEFNER lamp) but only a *temporary* one (existing in BEHNKEN's laboratory) that cannot be reproduced in other places, because, if some another person in a different place procures a 16 candlepower metal lamp and adjusts it for 0.16 A, he will get a different measure from that used by BEHNKEN.

Nor does BEHNKEN claim the use of an absolute standard which can be seen from his work, the same page 331, lines 11—13 from below, where he says:

»Die Eichung kann entweder empirisch am biologischen Objekt oder durch Vergleich mit irgendeinem als normal angenommenen Dosimeter, z. B. einer Ionisierungskammer, vorgenommen werden.»

The statement of Dr. CARLSTEN, then, is not according to fact.

My method of measuring is based upon an absolute standard, BEHNKEN's upon a temporary one.

Translation from Swedish by:

C. WESTMAN.

¹ Afterwards sent in by the author of this paper.



THREE TECHNICAL DETAILS

1. HOW TO EXTRACT SILVER FROM THE FIXING SOLUTION
2. A PHOTOGRAPHIC MARKING OF RADIOGRAMS
3. A SIMPLE ARRANGEMENT FOR COVERING THE FIELD TO BE TREATED WHILE THE ANTICATODE IS WARMED

by

Sigfrid Arnell, M. L.

1. There are of old a good many simple methods of extracting silver from the used fixing solution. After having tried a great many methods such as electrolysis, precipitation by the wet process by the aid of liver of sulphur, zinc dust, zinc-plate, iron, and copper, I have fixed my choice on extraction on copper-plate as being the most practical. The following is a description of my method.

The used fixing solution is poured into a large wooden vessel (metal vessels are soon corroded). Close to the bottom of this vessel there is an outlet, suitably consisting of a hole with a rubbertube inserted in order to make it easier to let out the fixing solution at the end of the process. In the wooden vessel are placed a number of copper-plates, 1—2 mm thick and of a size of 20 × 20 cm approximately. On these the silver precipitates as a black covering. Already after 48 hours most of the silver has precipitated. The copper-plate should then be well brushed clean of silver by means of a hard brush (preferably a steel brush), so that there may be an equal corrosion all over the surface of the copper-plate. After another 24 hours practically all the silver has been precipitated, and the fixing solution can be let out. However, one should put off letting out the fixing solution till one has another used fixing solution handy, for the copper-plate will get patinated if not covered with fluid. The precipitated silver should be rinsed from fixing salt before it is dried, and it generally does not hold more than 5 % at most of impurities (chiefly copper). The dried silver may be sold to a goldsmith or a silver-refinery. In a Roentgenological depart-

ment of average size with about 5,000 examination cases, one may thus save many hundred crowns yearly, which would otherwise pass through the outlet with the fixing solution.

*



Fig. 1—2. Photographic marked radiograms.

2. In every Roentgenological department with a great clientele the radiograms should be marked already when photographed or developed, so that no confusion of radiograms of different patients or of right and left may occur. Further, in some cases, different directions, such as anterior, cephal or lateral, should be indicated to facilitate a quick orientation. As is well known, such markings can be made in many ways.

In 1923 Dr. LAURELL and the author tried to produce distinct marks of orientation, which should also take up as little room as possible, to be exposed on the radiograms. This was caused by our then exchanging plates for duplitized films, which among other things make it more difficult to decide which is right and which is left on



Fig. 3. The marks placed on the cassette.

the radiograms. We made a good many experiments and tried for instance paper marks painted with red oxide of lead, marks cast of lead etc. The markings finally decided on and which were proposed by Dr. LAURELL consisted of letters, arrows and other marks made of thin copper wire fixed on the adhesion side of American plaster, which side then was covered with a piece of cleaned film. American plaster is more suitable for the purpose than leucoplast; contrary to leucoplast it gives a very insignificant shadow in Roentgen light. Their appearance will be seen from picture. (Figs 1 and 2.) In addition to markings to indicate right and left we have also for

the examination of the extremities marks consisting of arrows, indicating a lateral, cephal or anterior direction. The latter are of special value as they enable the doctors who are to examine the films to orientate themselves quickly, and also because they prevent a con-

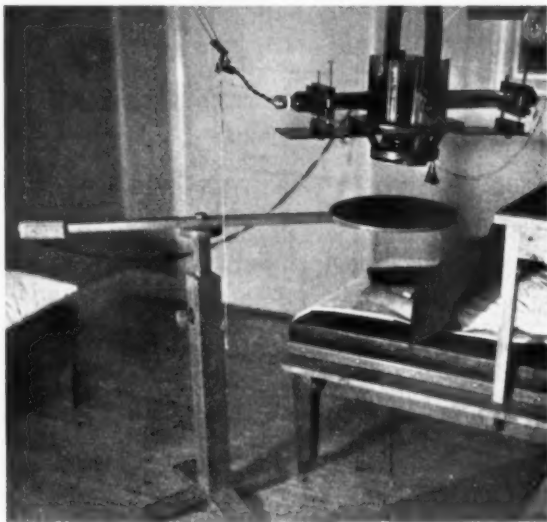


Fig. 4.

fusion of the directions of exposure when, by means of a transportable apparatus, fractures etc. are examined in a ward. These marks are fixed on the cassette and exposed on the film at the same time as that part of the body which is to be examined. The directions are clearly and distinctly indicated on the developed film. Further, a figure is exposed on each film; for each patient is given a number, and at the exposure a mark with this number is hung or placed on the cassette. By this means a confusion of films of different patients is made impossible.

*

3. A simple arrangement is suggested for covering the field to be treated while the anticatode is warmed, consisting of a plate, whose shape reminds of a baker's peel, with a thick cover of lead rubber fixed on a handle revolving on a stand. Its appearance may be best judged of from picture. (Fig. 4.) While the anticatode is warmed, the plate is placed between the tube and the field to be treated. From the manœuvre cabin one can turn the plate away when the treatment begins by pulling a string attached to the handle.

SUMMARY

The author proved some methods of extracting silver from the used fixing solution and found precipitation on copper-plate being the most practical. Great savings may be done by taking care of the silver in the used fixing bath.

Further the author and Dr. H. LAURELL have constructed marks for photographic marking of radiograms, consisting of figures, letters and arrows of thin copper-wire, fixed on American plaster and covered with a piece of cleaned film. By using them confusing of films from different patients and right or left side is to be avoided.

The author also describes a simple arrangement for protection of the field to be treated while the anticatode of the Coolidge-tube is heated. Its appearance may be best judged of from picture.

ZUSAMMENFASSUNG

Der Verfasser hat verschiedene Methoden für die Extraktion des Silbers aus verbrauchtem Fixierbad geprüft und die Ausfällung auf Kupferplatten am praktischsten gefunden. Durch Entziehung des Silbers aus der verbrauchten Fixierlösung können grosse Besparungen gemacht werden.

Ferner haben Verfasser und Dr. H. LAURELL Zeichen für die photographische Markierung der Röntgenogramme konstruiert. Sie bestehen aus Buchstaben, Ziffern und Pfeilen aus dünnem Kupferdraht, der mit einem Streifen amerikanischen Pflasters festgeklebt und von gereinigtem Film bedeckt ist. Bei Benutzung derselben vermeidet man die Verwechslung von Filmen verschiedener Patienten oder von rechts und links.

Der Verfasser beschreibt auch eine einfache Vorrichtung zum Schutze des Behandlungsfeldes während der Vorwärmung der Antikathode des Coolidge-rohres. Ihre Konstruktion geht am besten aus der Figur hervor.

RÉSUMÉ

L'auteur a examiné des différentes méthodes pour l'extraction de l'argent du bain de fixation et constate que la précipitation sur des plaques de cuivre résulte la plus pratique. De grandes économies peuvent être faites en recueillant l'argent des bains de fixation.

L'auteur ensuite en collaboration avec Dr H. LAURELL, a construit des marques, avec lesquelles les radiogrammes peuvent être photographiquement marqués. Ces marques consistent en des chiffres, lettres et flèches de fil de cuivre mince, fixées sur emplâtre américain et couvertes par des morceaux de film nettoyé. Par l'usage de ces marques l'on évite de confondre les radiogrammes de différents clients et des côtés gauches ou droits du corps.

L'auteur décrit ensuite un arrangement simple pour la protection du parti à traiter pendant le chauffage de l'anticatode avant le commencement du traitement. Pour la construction voir la figure.





R. D. Carman.

RUSSELL D. CARMAN

In Memoriam

The 18th of June a cablegram from the Mayo Clinic brought us the mournful tidings of the death of RUSSELL D. CARMAN.

Last summer he was suffering from digestive troubles, which gradually grew worse. In October a roentgen examination revealed an infiltrating lesion involving the middle of the stomach and at a subsequent surgical exploration, Nov. 14th, an inoperable cancer was found.

RUSSELL D. CARMAN was a typical and worthy representative of medical science in modern America and his work bears in many respects the distinctions characteristic of American medical research work of to-day. In his capacity as head of the roentgen department of the Mayo Clinic he was fortunate in having at his disposal large funds enabling him to bring the radiological institution to a state of completion and perfection, both as regards material equipment and personal staff. He had also brought his work to technical perfection.

The serious efforts for organized co-operation between the various branches of medicine, so characteristic of many modern American clinics, an ideal that at the Mayo Clinic more than anywhere else has been realized in full, has been eminently fruitful for CARMAN's work.

What perhaps is most noteworthy in CARMAN's scientific work is his painstaking control of the roentgen findings, obtained, partly by comparing these with the results at operations and findings at post-mortem examinations, partly through close co-operation with other clinics. Thanks to the exceedingly great number of cases at his disposal for examination and by careful and practical registration and preparation of the material, it thus became possible for CARMAN to accumulate an experience, greater, wider and more systematized than perhaps any other radiologist. Every statement therefore, from CARMAN, or contribution to a discussion, carried weight with it of an unusual degree that stimulated general attention and made him honoured by all.

A sincere keenness for research work, an acute power of observation and sound judgment made CARMAN a clinical observer of high class. In a paper on »the Future of Radiology» CARMAN particularly refers to two types of research workers, one group consisting of only scientists and another of »scientist, physician and inventor combined». He, himself, belonged in an eminent degree to the latter group and the goal of his life's work can largely be said to have been a furtherance of a broader knowledge of anatomy, physiology and pathology, as related to radiological phenomena and, on the basis of this wider knowledge, a more reliable radiological diagnosis with a consequent greater value to clinical diagnosis.

Among CARMAN's scientific works the most important one is his wellknown treatise on »Roentgen Diagnosis of Diseases of the Alimentary Canal», a subject which, on the whole, was his chosen field of pursuit. His works on the subject of roentgen diagnosis of conditions of the urinary tract are also of standing value, particularly his researches on pyelography and his work,

together with BRAASCH, on renal fluoroscopy. A great and important work has been achieved by CARMAN on the roentgenologic diagnosis of cholecystic disease. His paper at the first international radiological congress in London 1925 on 1100 cases examined by cholecystography gave a broad and critical view of this, at the present time, so important and difficult matter. At the time of his death CARMAN had been occupied for several years with an extensive work on the roentgen anatomy and pathology in the diagnosis of diseases of the respiratory tract. His publications are known for their clear and concise form. CARMAN has contributed very considerably as organizer of the practical radiological work. Under his guidance the roentgen department at the Mayo Clinic has developed into a model institution of great dimensions, where radiologists from the whole world have received impulses and gathered knowledge.

The great number of cases that had to be personally examined by CARMAN made it imperative for him to adopt a rapid mode of examination at which fluoroscopy was eminently dominant. It was a wonderful experience to see him carrying out his examinations on the fluorescent screen. A continuous run of patients, waiting in a queue, passed through the examination-room, sometimes as many as fifty in the course of a couple of hours, to immediately afterwards be radiographed in another room. Such a method of examination can only become useful in the hands of an operator who, like CARMAN, combines quickness of perception with acute power of observation, an eminently practical mind and great experience.

CARMAN was deeply interested in the teaching of radiology, convinced as he was of the vital necessity for radiology as well as for other branches of medicine of a thorough and extensive training.

He was quite clear about the fact that the difficulties encountered by the radiological science on its path forwards are not of any particular nature but depend upon problems, alike to all specialized branches of medicine.

It can be rightly said of RUSSELL CARMAN that he has contributed in an eminent degree to the development of radiological diagnosis from being merely a method of examination to its present status of a full-grown, independent and extensive science.

CARMAN was one of the leaders of the radiological societies of the United States of the Northern America and his great aim was centralization and concentration of the work of the various societies.

He was an honorary member of the Northern Society of Medical Radiology.

CARMAN had an imposing frame, an »eloquentia corporis» that de-

manded attention. His tall stature and distinctive features reminded one of an old Roman emperor, a good emperor in the empire of the beneficial rays.

The work of RUSSELL D. CARMAN was coupled with a sincere, honest and broadminded personality. The numerous radiologists who have visited him in his wonderful clinic or met him abroad mourn in him, not only the scientist, but also an exceedingly good fellow and many are those among us who have lost in him a good and steadfast friend. The kind and bright glance from his eyes will render luminous his memory.

G. F.



MITTEILUNG DER REDAKTION

Die *Schweizerische Röntgengesellschaft* ist am 3. März 1926 in die Redaktion der *Acta Radiologica* eingetreten, und unsere Zeitschrift ist hernach das offizielle Organ auch der Schweizerischen Röntgengesellschaft.

Diese Gesellschaft erwählt Ihre Repräsentanten in der Redaktion, und diese bilden zusammen eine lokale schweizerische Redaktion für die *Acta Radiologica*.

Es ist uns eine grosse Freude, die schweizerischen Radiologen als Mitglieder der Redaktion und Mitarbeiter der Zeitschrift herzlich willkommen zu grüssen.

Wir sind überzeugt, dass die *Acta Radiologica* durch die schweizerischen Beiträge einen sehr wertvollen Zuschuss erhalten werden, und wir hoffen auf eine lange und für die Entwicklung unserer Wissenschaft fruchtbare Zusammenarbeit.

BERICHTIGUNG ZU DEM AUFSATZ: »EINIGE UNTERSUCHUNGEN ÜBER DIE INTENSITÄTSVERTEILUNG BEI DEN IM RADIUM-HEMMET GEBRÄUCHLICHEN DISTANZBEHANDLUNGEN«

von

Rolf M. Sievert, Stockholm

Infolge eines Versehens hat sich in dem betr. Aufsatz ein Fehler eingeschlichen. Es steht dort auf Seite 220: »Da das Sekundärfiltrum höchstens 8 % der Strahlung zu absorbieren im Stande ist, kann man leicht den Schluss ziehen, dass die von Platte A und deren Umgebung ausgehenden Sekundärstrahlungen durch Filtrum B mindestens um 75 % bei a) bzw. um 85 % bei b) herabgesetzt werden.« Es ist selbstverständlich unmöglich, aus den angegebenen Zahlen einen solchen Schluss zu folgern. Die Prozentzahlen beziehen sich nicht auf die Herabsetzung der Intensität der sekundären Strahlen, sondern nur auf den Anteil an der durch die Filterung hervorgerufenen Intensitätsabnahme, die durch Absorption weicher Strahlung entsteht.

FACULTÉ DE MÉDECINE DE STRASBOURG

CENTRE RÉGIONAL DE LUTTE ANTICANCÉREUSE PAUL STRAUSS

COURS DE PERFECTIONNEMENT

SUR LE

C A N C E R

Cet enseignement aura lieu du lundi 18 octobre au samedi 6 novembre 1926 et comportera :

1^o *Des exercices pratiques* au Centre anticancéreux, tous les jours de 9 heures à midi et de 3 à 5 heures sous la direction du Dr Gunsett.

a) *Röntgenthérapie Profonde* avec manipulation des appareillages.

b) *Curiéthérapie* (appareils moulés, radiamponcture, etc.).

Les élèves auront également libre accès, aux services de Radiodiagnostic et de Physiothérapie (Diathermie, ultraviolet, infrarouge, etc.) qui se trouvent dans un bâtiment contigu.

2^o *Des cours théoriques* au Centre anticancéreux à partir du 18 octobre.

Les bases biologiques de la Radiothérapie des Cancers.

Les bases physiques de la Röntgenthérapie des Cancers.

Les bases physiques de la Curiéthérapie des Cancers.

Les accidents causés par les rayons X et le Radium.

Indication et Technique d'application de Röntgenthérapie et de Curiéthérapie dans les différents cancers.

3^o *Des cours théoriques dans les cliniques et instituts de la Faculté de médecine :*

Samedi, 23 Octobre. M. BORREL: Le Problème du cancer.

Du lundi 25 au jeudi 28 Octobre. M. CANUYT: a) Tumeurs des fosses nasales et des sinus.

b) Tumeurs du pharynx. c) Tumeurs du larynx. d) Tumeurs de l'oesophage.

Vendredi, 29 Octobre. LERICHE: Traitement des ostéosarcomes.

Samedi, 30 Octobre. MASSON: Histodiagnostic du cancer. Biopsie.

Lundi, 1^{er} Novembre. M. PAUTRIER: Les tumeurs de la peau.

Mardi, 2 Novembre. M. SCHICKELE: Les cancers de l'utérus, les cancers des autres organes génitaux.

Mercredi, 3 Novembre. M. STOLZ: Tumeurs de l'estomac, des intestins et du rectum.

Jedi, 4 Novembre. M. WEIL: Tumeurs de l'œil.

Vendredi, 5 Novembre. M. MALLET: Les applications de l'ionomicrométrie à la pratique de la Curiéthérapie des cancers. M. De NABIAS: L'index Karyokinésique et son application à la technique de la Curiéthérapie des cancers.

Samedi, 6 Novembre

Séance publique de clôture (à la clinique médicale A de la Faculté)

sous la Présidence de Monsieur Paul Strauss, sénateur, ancien ministre de l'Hygiène.

9 heures Communications avec discussion:

MM. Neumann et Coryn (Bruxelles). Le traitement des cancers du rectum. M. Proust (Paris). Le traitement des cancers du rectum. M. Roussy (Paris). Le mécanisme de l'action des radiations sur le cancer. Mme S. Laborde (Paris). Technique et résultats du traitement des cancers du col de l'utérus. M. Gunsett (Strasbourg). La Curiéthérapie des cancers cutanés (projections).

15 heures ¹/₂ Les caractéristiques physico-chimiques de l'organisme normal et de l'organisme cancéreux.

MM. Vlès et De Coulon.

20 heures Banquet de clôture.

S'inscrire auprès du Dr Gunsett, Directeur de Centre anticancéreux, Hôpital Civil à Strasbourg. UN DROIT D'INSCRIPTION de 250 francs sera versé au Secrétariat de la Faculté de médecine.

Un certificat sera donné aux auditeurs à la fin du cours. Le nombre des auditeurs est limité.

Le Doyen de la Faculté de Médecine,
Président du Conseil d'administration du
Centre anticancéreux:

VEISS

Le Directeur du Centre anticancéreux:

GUNSETT

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